1983 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-SEVENTH CONGRESS

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*On assignment to Budget Committee for 97th Congress.

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1983 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

TUESDAY, FEBRUARY 9, 1982

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY,
Washington, D.C.

The subcommittee met, pursuant to notice, at 1:35 p.m., in room 2318, Rayburn House Office Building, Hon. Doug Walgren (chairman of the subcommittee) presiding.

Present: Representatives Walgren, Brown, Weber, Gregg, and Skeen.

Mr. WALGREN. Let me call us to order so that we can proceed.

Today we begin a review of the budget proposals for the National Bureau of Standards for fiscal year 1983. These authorization hearings will continue tomorrow and include a review of the Bureau's fire and earthquake programs and the Institute for Computer Sciences and Technology, as well as the National Technical Information Service and the Office for Productivity, Technology, and Innovation. These related agencies were part of our authorization legislation 2 years ago. They are also under our jurisdiction and are important science and technology agencies of the Department of Commerce.

This is the second time in its 81-year history that the National Bureau of Standards will be the subject of budget authorization hearings in the House of Representatives. The first authorization process covered the NBS budget for fiscal years 1981 and 1982. This subcommittee also held hearings in July 1981 to review the Bureau's Organic Act. The Organic Act, the basic charter for NBS, was last reviewed and amended by the Congress in 1950.

The lack of controversy concerning the Bureau's functions and resources is in fact testimony to an enviable reputation it has for scientific and engineering excellence in the United States and in the international area. However, today's budgetary environment requires that we insure that NBS has identified those priorities which are vital to both the Government and the private sector in increasing productivity and achieving a higher level of industrial innovation. We must insure that budgetary resources are not only adequate but are allocated in a way which will provide the most constructive balance between basic research and technical support of industry as well as Government.

The National Bureau of Standards performs an important function in advancing the Nation's commerce and industry and in pro-

tecting the American consumer. Although the subcommittee received the Bureau of Standards' budget only yesterday, this early review of their priorities and allocations will allow us to evaluate their plans and compare them closely to our review of the short-term priorities which we begin today.

Closely related to our review of the short-term priorities is our review of the long-term functions and priorities which I expect will continue later this year with the review of the Bureau's Organic Act.

It will be important to evaluate the adequacy of this charter in meeting long-range science and engineering goals. This is especially true in a period when very great organizational changes are taking place in the Department of Commerce involving both energy and information technology.

Our review this week will include programs conducted jointly with the National Bureau of Standards and other agencies, mainly the Federal Emergency Management Agency. We will be interested to learn of the scope and the funding proposed for the Office of Productivity, Technology, and Innovation and how the Department of Commerce proposes to absorb the functions of the Smithsonian Science Information Exchange which, upon its closure in October 1981, were transferred to the National Technical Information Service. These related functions are essential to the effective transfer of the research and technology products not only of the Bureau of Standards but the important scientific and technical information produced by a number of other Federal agencies.

Our first witness today is the gentleman from Texas, the Honorable Phil Gramm. Mr. Gramm is particularly interested in a number of aspects of the Bureau of Standards. Perhaps we can proceed with Mr. Gramm and, depending on the length of your statement, we will make that vote or be happy to suspend and return if it fits with your interest.

[A biographical sketch of Mr. Gramm follows:]

CONGRESSMAN PHIL GRAMM
1721 Longworth House Office Building
Washington, D.C. 20515
(202) 225-2002

B I O G R A P H Y

(William Philip) PHIL GRAMM, Democrat, of College Station, Texas; born in Fort Benning, Georgia, July 8, 1942; B.B.A. (Economics), 1964, Ph.D. (Economics), 1967, University of Georgia. Professor of Economics, Texas A&M University, 1967-78; partner, Gramm and Associates, 1971-78. Author of several books and monographs, including The Economics of Mineral Extraction and articles in the American Economic Review, the Journal of Money, Credit and Banking, and the Journal of Economic History and guest editorials in the Wall Street Journal. Special Consultant on Environment and Taxation, Ministry of Natural Resources, Province of Ontario, Canada, 1973-78; Member, Gulf Universities Research Consortium, Energy Programs Planning Council, 1974-76; former consultant, U.S. Bureau of Mines, National Science Foundation, Arms Control and Disarmament Agency and U.S. Public Health Service. Named one of five Outstanding Young Texans of 1977 by the Texas Jaycees. Married Wendy Lee, of Waialua, Hawaii, 1970; two children, Marshall Kenneth and Jefferson Philip; Episcopalian.

Elected to the 96th Congress, November 7, 1978; reelected, November 4, 1980. Member, Budget Committee, Energy and Commerce Committee (subcommittees on Conservation and Power, Fossil and Synthetic Fuels, and Health and the Environment) and Veterans' Affairs Committee.

Coauthor of the Gramm-Latta budget, mandating spending reductions totalling $143 billion in fiscal years 1982-84 (adopted May 7, 1981). Coauthor of the Gramm-Latta II omnibus reconciliation bill which changed existing law to reduce the level of expenditure for 250 federal programs, lowering federal outlays by a total of $131 billion in fiscal years 1982-84 (signed into law August 13, 1981). Author of the Safe Drinking Water Act amendments, which limited the ability of the Environmental Protection Agency to impose regulations which would have been costly to water consumers and which would have limited oil and gas production (enacted December 5, 1980).

SIXTH DISTRICT OF TEXAS - Counties: Brazos, Ellis, Hill, Johnson, Limestone, Navarro and Robertson; the southern portion of Dallas, Parker and Tarrant counties; the city of Streetman in Freestone County. Population: 634,182 (1980).

[Legislative Redistricting Plan, adopted by the Texas Legislature, August, 1981: Brazos, Ellis, Freestone, Grimes, Hill, Hood, Johnson, Leon, Limestone, Madison, Navarro and Robertson; the southwestern portion of Dallas County and the western and central portions of Montgomery County. Population: 527,393 (1980 Census).]

STATEMENT OF HON. PHIL GRAMM, A MEMBER OF CONGRESS FROM THE STATE OF TEXAS

Mr. GRAMM. Thank you, Mr. Chairman.

I appreciate having the opportunity to come here today to talk about the mandate of the Office of Weights and Measures of the National Bureau of Standards. It is seldom in this era that we spend a lot of time talking about the budget and mandate of an agency that spends $800,000 a year, when it takes $50 million to get an asterisk in the Federal budget. I think it is an indication that on this committee you are doing something right and, Mr. Chairman, I would like to congratulate you for it.

I have a very short statement I would like to put in the record, Mr. Chairman.

Mr. WALGREN. Without objection, that will be made part of the record. Please proceed.

Mr. GRAMM. I would basically like to make one point. I am not here today to in any way complain about the performance of the Office of Weights and Measures. They are carrying out a legitimate Federal function, a function that they have carried out, I think to the satisfaction of those who are engaged in energy and commerce, for a very long time.

However, I would like to express a concern, Mr. Chairman, that I would like this subcommittee to consider as you deliberate on the mandate and on the level of authorization for the Office of Weights and Measures. In the last 10 years we have had a technological revolution where we have moved away, basically, from mechanical devices that were used to gage weights and measures to the use of electronic and computer devices.

These devices are, in general, far more accurate and are actually cheaper to those engaged in industry and agriculture who use these devices. The problem arises, Mr. Chairman, in that the States do not have at this time in the field the expertise to gauge the accuracy of these devices. This presents, in my opinion, a very real void and the void is compounded by the fact that those items that they are seeking to measure have grown in value.

I give you an example—gasoline. In the last 5 years gasoline has gone up by over 300 percent. Throughout the country we have had a movement away from the old mechanical gage which was used to measure gasoline sold to the American motorist to a new electronic gage which, again, when functioning properly is more efficient both in measurement and in terms of cost of the measurement.

However, a problem that I am continually reminded of by the Commissioner of Agriculture in my State—who is given the mandate to proctor and to gage the accuracy of weights and measures throughout the State of Texas, and who works with the National Bureau in that activity—is that they do not have the expertise, the manuals, or the training to assure that those who are engaged in the process of checking these measuring devices are able to ascertain as to whether or not they are measuring correctly.

I think this is a void that ought to be dealt with. I think it is a legitimate Federal function for us to develop the manuals, the techniques, and to provide to some extent seed money for a training program to teach people how to gauge the accuracy of these devices

and gauge whether they are working. I believe it is a legitimate State function to pay for the ongoing measurement and ultimately to pay for the manuals and for the training but I think we have to provide the expertise, and I would simply like to ask this subcommittee to look at this particular problem which is currently not being addressed.

[The prepared statement of Congressman Gramm follows:]

TESTIMONY OF THE HONORABLE PHIL GRAMM
BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY
FEBRUARY 9, 1981

Mr. Chairman, thank you for this opportunity to express my interest in the mandate of the Office of Weights and Measures of the National Bureau of Standards. It is not often that we look closely at the functions of a federal office that spends "only" about $800,000 per year but I hope you will agree that the Office of Weights and Measures merits this attention.

For more than 75 years, the Office has coordinated the development of weights and measures standards and enforcement practices which have been voluntarily adopted by the states. The Office has served as the Secretariat for the National Conference on Weights and Measures and has provided technical and educational assistance to both the states and industry. For this work, the Office has received continued praise and support from all segments of the weights and measures community.

I am asking the Subcommittee to review the functions of the Office not because there is anything "wrong" with its current operations. However, there has been a revolution in the field of weights and measures in the past 10 years and neither the states nor the Office is equipped to handle the challenge which this revolution has presented to the enforcement community.

Mr. Chairman, I think all of us are aware of the magnitude of the shift in this country toward measurement devices which rely on electronic and computer technologies. Measurement of everything from groceries to gasoline to crude oil now depends on technologies which did not exist 10 or 20 years ago. Unfortunately, the enforcement capabilities of state weights and measures agencies have not kept up with this rapid application

of technology. There is currently no integrated program or curriculum through which states can familiarize their weights and measures officials with the new measurement technologies and ensure that consumer interests are protected.

The importance of adequate weights and measures enforcement programs and of the role of the Office in the development of those programs has been noted in testimony and letters received by this Subcommittee from the National Conference, the Scale Manufacturers' Association, the National Association of State Departments of Agriculture, and numerous regional and state weights and measures agencies. No one has suggested that the federal government should assume new powers over weights and measures standards and enforcement, but there is a widespread concern that the Office does not have the resources to provide the assistance the states and industry will need to face the challenges of new technologies. I would like to add my voice to those who urge you to consider the needs of the weights and measures community and indicate through this authorizations process the Subcommittee's intent that the Office should receive the funds it needs to fulfill its technical and educational functions.

Mr. WALGREN. Well, I appreciate that very much. Certainly, coming from you and in view of your interest in backing the Federal Government out of a number of areas where it has developed programs, that would stand as stark testimony that the needs in this area are essential, are well founded, are properly balanced in the Federal area, to be sure, and this committee should give every attention to making sure that function is fully funded to the satisfaction of the problem. Well, let me say that a different way: fully funded adequately to address the problem. So many of our efforts on the Federal level are not funded adequately to address the problem but if you support that kind of effort in the Federal Government, that is pretty good testimony.

Mr. GRAMM. I appreciate that, Mr. Chairman. I think it is vital—especially in the areas where the value of the goods being measured has grown so rapidly over the last 5 years, and where we have a technology being used to measure what did not exist 10 years ago—that we clearly have a mandate in promoting commerce and industry to assure that people get fair measure.

Mr. WALGREN. Any questions by members of the subcommittee? Mr. Brown?

Mr. BROWN. I just wondered if Mr. Gramm had any specific numbers in mind in connection with this item? We will probe that with Dr. Ambler, of course.

Mr. GRAMM. I really do not have the number in mind or the expertise. I simply was relaying a problem which has come to my attention through the commissioner of agriculture in my State, in working with a university where I used to teach. Those in Texas who are trying to do the job of assuring that these new weights and measures are accurate and are trying to certify under law that they are accurate, have repeatedly sent me memos and visited with me concerning their inability to put people in the field who are adequately trained to do the job. It is not that they are saying that there is anything, any intentional or unintentional mismeasurement. It is just basically that they do not have the capacity to find out.

Mr. WALGREN. Thank you very much. We appreciate your time.

We will recess to make this vote on the floor. It should not take more than about 12 to 15 minutes.

[Recess taken.]

Mr. WALGREN. OK, let us proceed.

The next witness is the panel from the National Bureau of Standards led by Dr. Ernest Ambler, the Director of the Bureau, accompanied by Dr. John Hoffman, the Director of the National Measurement Laboratory; Dr. John Lyons, the Director of the National Engineering Laboratory, and Mr. Kammer, the Deputy Director of the Bureau.

Welcome, gentlemen. We are pleased you would come and join with us in this discussion. Written statements will be made part of the record automatically. Feel free to summarize if possible or proceed however you feel is most effective.

Dr. Ambler?

[The biographical sketch of Dr. Ambler follows:]

DR. ERNEST AMBLER

Dr. Ernest Ambler became the 8th Director of the National Bureau of Standards in February 1978. At the request of Secretary Baldrige he has continued as Director under the Reagan Administration.

As Director of NBS Dr. Ambler leads the nation's central reference laboratory. NBS provides measurement methods, standards, and data that are used in industry, commerce, government and universities. NBS also applies its technical resources in helping solve problems of broad national importance. The Bureau's headquarters are located in Gaithersburg, Maryland, with a second laboratory at Boulder, Colorado. Total staff numbers about 3200, over half working in scientific and technical areas.

Dr. Ambler joined NBS in 1953, and has worked throughout his career to make NBS an increasingly valuable scientific and technical resource for industry, business, government, education, and the public. As a scientist, he has contributed directly to the state-of-the-art in measurement technology. His expertise in nuclear physics and cryogenics formed the basis in 1956 for a cooperative effort that disproved the law of parity conservation, a concept that nuclear scientists had adhered to for more than 30 years. This pioneering project confirmed experimentally the theoretical work of Nobel Prize winners T. D. Lee and C. N. Yang.

As an administrator, Dr. Ambler has helped guide Bureau operations and policies to improve the efficiency with which NBS fulfills its mission. His management responsibilities began in 1961 when he became Chief of the Cryogenic Physics Section. Four years later, he was appointed Chief of the Inorganic Materials Division. In 1968, as Director of the Institute for Basic Standards, he assumed responsibility for directing the most basic of NBS research activities: developing and maintaining standard and measurement techniques for such quantities as length, mass, time and frequency, and temperature.

In 1973 he was appointed Deputy Director, and Acting Director in 1975.

Among Dr. Ambler's continuing concerns is the Bureau's role in international science. He has long acknowledged that through its mission and diversity, the Bureau can act as a prime agent in international scientific cooperation and can support U.S. foreign commerce through participation in international standardization activities. In 1972, Dr. Ambler was elected to serve as the U.S. representative to the International Committee of Weights and Measures (CIPM), the executive body of the General Conference of Weights and Measures. In addition, he serves as chairman of the Consultative Committee on Standards for Measuring Ionizing Radiations of the CIPM. In September 1981 he became the Department of Commerce member of the Board of Governors of the Israel/U.S. Binational Industrial Research and Development Foundation.

Dr. Ambler is a member of the American Association for the Advancement of Science, a fellow of the American Physical Society, and as Director of NBS is ex officio President of the National Conference on Weights and Measures.

Dr. Ambler is the recipient of numerous honors, awards, and fellowships including: The Department of Commerce Gold Medal, the NBS Stratton Award, Nuffield Fellow of Oxford University, the John Simon Guggenheim Memorial Foundation Fellowship Award, the John Price Wetherill Medal of the Franklin Institute, the Washington Academy of Sciences Award, the Arthur S. Flemming Award, the William A. Wildhack Award, and the President's Award for Distinguished Federal Civilian Service. He has authored 51 publications and holds a patent for low temperature refrigeration apparatus and processes.

Born in Bradford, Yorkshire, England, in 1923, Dr. Ambler earned his B.A., M.A., and Ph.D. in physics at Oxford University before coming to the National Bureau of Standards. He became a United States citizen in 1958. Dr. Ambler and his wife, Alice Seiler Ambler, a former staff member in the NBS Heat and Building Research Divisions, were married in 1955. They live in Bethesda, Maryland, and have two sons, Christopher and Jonathan.

STATEMENT OF DR. ERNEST AMBLER, DIRECTOR, NATIONAL BUREAU OF STANDARDS, ACCOMPANIED BY RAYMOND G. KAMMER, DEPUTY DIRECTOR, NATIONAL BUREAU OF STANDARDS

Dr. AMBLER. Thank you, Mr. Chairman.

I will summarize the witness statement. I am requesting authorization of $104,362,000 for fiscal year 1983 activities of the National Bureau of Standards. This includes funding for measurement research and standards, for engineering measurement and standards, and for central technical support. A copy of a draft bill showing the amounts requested for fiscal year 1983 is attached to my statement.

Our request does not include authorization of appropriations for the Institute for Computer Sciences and Technology [ICST]. The administration is proposing to transfer ICST to the General Services Administration [GSA] in fiscal year 1983, and funding for the activities of ICST is included in GSA's budget request. Shortly, the Secretary of Commerce and the Administrator of the General Services Administration will submit legislation for consideration by the Congress to accomplish this transfer.

A draft bill which has been submitted to the Congress simultaneously with the President's budget also would authorize in fiscal year 1983 activities of the National Technical Information Service. Dr. Caponio will testify on NTIS tomorrow.

I would now like to point out several changes in the budget request for NBS for fiscal year 1983. Our request includes direct support for most of NBS's fire research activities. In the past, the largest portion of this funding has been appropriated to the Federal Emergency Management Agency and then passed through to NBS. Our response to the Earthquake Hazards Reduction Act of 1977,

which has also been partially funded by FEMA in the past, will be continued in fiscal year 1983 with direct NBS funding of $475,000.

We are requesting program decreases in several areas, consistent with the administration's desire to hold down Federal spending. The factors considered in the identification of these areas were: minimum disruption to our core research programs through reduction in force; availability of feasible alternatives to accomplish program goals; and relative priority within NBS.

Our environmental measurements program will not be continued in fiscal year 1983. We expect that EPA will provide industry and Government agencies with the necessary technical data and assistance.

Our competence building program has been reduced by $1 million in 1983. This is, in fact, elimination of the increase of $1 million approved in fiscal year 1982. We were able to effectively use the 1982 funds to equip several projects that will be continued with ongoing resources.

The major objectives of our recycled materials program have been achieved to the point where it is now appropriate for the private sector to continue further efforts to satisfy their specific requirements. This makes possible a $3.1 million reduction in our request for fiscal year 1983.

We are also reducing our direct funding for research on the properties of new-process metals and on automated manufacturing. Both of these are reductions to increases approved in fiscal year 1982. In both cases we were able to use the 1982 funds to establish capability which could be continued at lower levels of appropriated funds. Other agency funding and cooperation with the private sector make these reductions possible.

The amount requested for acquisition of an upgraded NBS computer, which was initially funded at the $9.3 million level in fiscal 1982 has been reduced by $5.6 million to $3.7 million for fiscal year 1983. In this case we have evaluated leasing versus outright purchase of certain system components and are confident that the lease option will permit us to move ahead with the acquisition of the computer capability we need, but at a lower annual cost.

I will now discuss progress in some of our technical areas. NBS has programs in areas of technology that are of increasing importance to the strength of the U.S. economy. These programs were developed through interactions with this subcommittee, numerous contacts with industry, and cooperation with professional and industrial associations. These programs are in semiconductor electronics, materials science, automated manufacturing, and chemical engineering. They all are designed to facilitate the prompt introduction or exploitation of new technologies by supplying required measurements, standards, or data.

The semiconductor electronics program focuses on very large scale integrated circuits, specifically to improve the quality and reduce the cost of testing such circuits. NBS measurement services are being very well received, and professional and trade associations are adopting standards based on NBS work.

The goal of our materials research program is to facilitate more effective use by industry of a wide variety of materials. In 1982 we are expanding basic work underlying rapid solidification and alloy

coatings. These new processing technologies show promise of leading to new materials with properties superior to any that now exist.

As you know, we are assembling a small experimental automated manufacturing facility. This facility will be used to address the complex problems of measurements of both the machine and work piece, and of developing standards needed for the interconnection of design, manufacturing, and measurement systems.

Our chemical engineering program has recently developed a computer code for predicting the transport properties of hydrocarbon mixtures over a wide range of industrial conditions. This code has been made available and is being widely used by industry for design of chemical processes and process equipment.

We are also continuing to pursue vigorously our more traditional activities of research and development leading to and supportive of measurement services, critical data evaluation, and the provision of standard reference materials for a broad range of industries and public organizations.

In the interest of further improving our interactions with industry, we intend to expand our longstanding industrial research associates program. This program currently enables about 100 scientists and engineers, paid by private companies, trade and professional associations, and other organizations, to work at NBS on cooperative research projects. We hope to increase this program's size by 10 percent at the end of fiscal year 1982 and to double it within the next 5 years.

We are also strengthening the NBS Office of Weights and Measures. The recent introduction of new technology into the marketplace has created new needs for technical support. As a consequence, we are increasing the funding in fiscal year 1982 for the Office of Weights and Measures by about 15 percent, and are considering making the Office of Weights and Measures part of my office. We are also working closely with the National Conference on Weights and Measures to insure that the Office of Weights and Measures programs are responsive, and to discuss how State and local officials, as well as scale manufacturers and the Bureau, might work together to meet weights and measures needs in domestic and international commerce.

During the week of January 25 we met with the committees of the National Conference on Weights and Measures at NBS. We briefed them on our resources and plans. I personally met with several of the conference leaders as well as with State officials and with industry representatives. I intend to continue this close working relationship in the future.

NBS has recently developed, in the area of basic measurements, a new time scale. This system, which won an Industrial Research I-R 100 award, is more than 10 times more accurate than previous systems. It should prove to be a most effective solution to the common problem of intercomparing clocks.

Another significant activity during the past year was our investigation of the collapse of two walkways at the Hyatt Regency Hotel in Kansas City. NBS was called upon by congressional and local officials to perform this investigation because of its reputation for third-party impartiality, its measurement expertise, and its recog-

nized competence in the field of structural engineering. Our report, to be released this month, will focus on to the technical reasons for the collapse.

Mr. Chairman, the expanded authorities granted in our last authorization act for NBS participation in international scientific activities have been most beneficial. During 1981, 32 guest workers came to the NBS under this new authority, costing only one-eighth as much as would have been required for payment in full. During fiscal year 1981, NBS received reimbursements in fellowships for its employees which amounted to about $135,000 and resulted in important communications with foreign scientists that NBS would not have had otherwise. I appreciate the subcommittee's foresight in advocating these new authorities for the National Bureau of Standards.

I will now discuss a number of areas which have been of special interest and concern to the members of this subcommittee.

As you know, NBS, like most Federal agencies, has been required to reduce its overall personnel ceiling. Specifically, a reduction of 369 positions was to be achieved at NBS by the end of fiscal year 1982. A 2 for 1 hiring freeze, retirement, and normal attrition accounted for 205 positions.

To minimize the hardship on affected employees, we conducted a job assistance program throughout the reduction-in-force process. About 60 percent or 160 of the employees who were displaced participated in the program, as did 76 percent of the employees who were separated for reasons other than retirement. This was an extremely successful program and I intend to continue it for the time being.

In 1982 we are reducing no technical positions supported by direct appropriations. However, we are conducting a reduction in force of about 40 overhead positions. This action is being taken partly in response to the Secretary's goals of reducing the cost of overhead and support functions, and partly through my own recognition of the need to reduce overhead costs charged to our direct technical programs.

With regard to our efforts to upgrade NBS's computing capability, a transition computer is scheduled for delivery this month. In fact, Mr. Chairman, it arrived at the Bureau this morning. A request for procurement for a computer to replace NBS's main computer was released in December 1981, with the new computer expected to be fully operational in fiscal year 1984. The schedule may slip, however, because Congressman Brooks has asked the General Accounting Office to study potential advantages of consolidation of the NBS and NOAA planned computer purchases.

Mr. Chairman, NBS has undergone some significant changes since our last reauthorization. In recognition of the Bureau's critical role within the Department, Secretary Baldrige has directed that I report directly to him. This upgrading reflects the enhanced stature and responsibility of the Bureau within the Department.

Our programs and staff have been reduced but I firmly believe that our general level of accomplishment has been and will remain outstanding. I look forward to working with your committee toward greater achievements in the future.

Thank you very much, Mr. Chairman.

[The prepared statement of Dr. Amber follows:]

PREPARED STATEMENT OF ERNEST AMBLER, DIRECTOR, NATIONAL BUREAU OF STANDARDS

Mr. Chairman and members of the subcommittee: I am pleased to appear before you to request the authorization of appropriations for fiscal years 1983 and 1984 for the activities of the National Bureau of Standards (NBS).

I am accompanied today by my Deputy Director, Mr. Raymond G. Kammer; by Dr. John D. Hoffman, Director of the NBS National Measurement Laboratory; and by Dr. John W. Lyons, Director of the NBS National Engineering Laboratory. Dr. Hoffman and Dr. Lyons will highlight the activities, accomplishments and plans for each of those laboratories.

I am requesting authorization of $104,362,000 for the fiscal year 1983 activities of the National Bureau of Standards. This amount does not include funding for salary adjustments. For fiscal year 1984, I am requesting an authorization of such sums as may be necessary.

Before I discuss the details of this request, I would like to discuss our progress in some of our newer programs, our efforts to increase our emphasis on several traditional activities, and the information you requested on our final budget levels for fiscal year 1982.

PROGRESS IN OUR NEWER PROGRAMS

NBS is conducting several programs in areas of technology that are of increasing importance to the strength of the U.S. economy. The plans for these programs were worked out over the past few years through interactions with this Subcommittee, numerous contacts with industry, and through cooperation with professional and industrial associations. These programs are in semiconductor electronics, materials science, automated manufacturing, and chemical engineering. They all are designed to reduce or remove technical barriers related to measurements, data, or standardization that impede the prompt introduction or exploitation of new technologies.

The semiconductor electronics program focuses on very large scale integrated (VLSI) circuits and on the electrical and dimensional measurements needed to facilitate manufacturing and marketing semifinished and finished VLSI circuit products. We are making significant progress in developing methods and protocols for testing microchips containing very complex electronic circuitry. This will improve quality control and reduce the costs of testing. The program was planned and is being conducted in close cooperation with industry. Consequently the measurement technology and information developed by NBS is being readily transferred to and used by industry. NBS' measurement services are being very well received, and professional and trade associations are adopting documentary standards based on NBS work. Several training courses for technical leaders from industry have been held to facilitate the transfer of measurement technology.

The materials science program provides industry with measurement methods, data, and standards for characterizing the physical, chemical and mechanical properties of materials. The goal of the program is to facilitate more effective use by industry of a wide variety of materials. The methods, data and standards developed provide invaluable support to industry in materials selection, design and processing. In FY 82 we are expanding basic work unlying rapid solidification and alloy coatings. These new processing technologies show promise of leading to new materials with properties superior to any that now exist. NBS will focus on the scientific basis, the fundamental understanding of such phenomena as diffusion rates, alloy phase stability, and wear and corrosion resistance, all of which are needed to design and make new materials compositions and structures.

The automated manufacturing program addresses the problems of dimensional measurements of manufactured parts as well as of the very complex standards needed to permit and facilitate the interconnection of many computer-controlled machines tools, test stations, robots and conveyors into one automated manufacturing system. We are setting up a small automated manufacturing system to be used as an experimental facility to develop and verify measurement and interconnection methods.

The chemical engineering program is designed to provide methods for predicting the physical properties of complex mixtures, measurement methods for process control, measurement standards and calibration services for equitable exchange of commercial liquids and gases. The chemical engineering program has recently developed methods and a computer code for predicting the transport properties of hydrocarbon mixtures over a wide range of industrial conditions. This code has been

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made available and is being widely distributed to industry for design of chemical processes and process equipment.

PROGRESS IN TRADITIONAL AREAS

While our newer programs give emphasis to the Bureau's role in helping to solve significant new technological problems facing industry today, we are continuing to vigorously pursue our more traditional activities of research and development leading to and supportive of measurement services, critical data evaluation, and the provision of standard reference materials for a broad range of industries and public organizations. The results of fundamental and applied research carried out in our laboratories and our interactions with out clientele cause continuous change in our traditional programs as projects are completed and new ones are picked up.

In the interest of further improving our interactions with industry, we intend to expand our longstanding industrial research associates program. This program currently enables about 100 scientists and engineers from private companies, trade and professional associations, and other organizations to come to NBS as research associates to participate in cooperative research projects. These associates are paid by their sponsoring employers or organizations rather than by NBS. We hope to increase this program's size by 10% by the end of fiscal year 1982, and to double it within the next five years. We have more than 200 projects suitable for collaboration and are especially interested in having research associates participate in our newer programs. We are expanding the program because of its demonstrated benefits. The program gives research associates the opportunity to develop, learn, and take new skills back to their companies and organizations. It allows them to benefit from the use of NBS facilities and from collaborations and consultations with the NBS professional staff. At the same time, NBS receives the services of highly trained professionals and learns first-hand the views and needs of the industrial community. In these times of tight Federal budgets and competitive industrial challenges from abroad, such cooperation between government and industry is crucial.

We are also strengthening the NBS Office of Weights and Measures (OWM). During this Subcommittee's hearings in review of the Bureau's Organic Act last June, several of the witnesses expressed concern regarding a perceived lack of emphasis by the Bureau on its weights and measures program. The recent introduction of new technology into the market place has created new needs for technical support from NBS. As a consequence, we are taking steps to respond to these needs in spite of existing budget constraints. For fiscal year 1982, we are increasing the funding for the Office of Weights and Measures (OWM) by about 15%, and are considering making OWM part of my Office. We are also working closer with the National Conference on Weights and Measures to ensure the OWM's programs are responsive, and to discuss how State and local officials, as well as scale manufacturers, and the Bureau might work together to meet weights and measures needs in domestic and international commerce. During the week of January 25, we met with committees of the National Conference on Weights and Measures at NBS. We briefed them on our resources and plans and held extensive discussions. I personally met with several of the Conference leaders, as well as with State officials and with industry representatives. I intend to continue this close working relationship in the future.

FISCAL YEAR 1982 BUDGET

Mr. Chairman you have requested information on the Bureau's final budget levels for fiscal year 1982. Under the Third Continuing Resolution, Public Law No. 97-92, NBS is operating at an annual rate of $120,278,000. Table I which follows sets forth the appropriations levels authorized for FY 1982 and the appropriations levels included in the Third Continuing Resolution. The Table breaks down these levels by the line items contained in our last reauthorization of appropriations (Pub. L. 96-461).

ACCOMPLISHMENTS

Since our last authorization hearing before this Subcommittee, NBS has had, in my opinion, two years of solid technical accomplishment. Dr. Hoffman and Dr. Lyons will give you some details of these accomplishments. I would like to mention just two items that illustrate the range and depth of our work.

TABLE I.—COMPARISON OF FISCAL YEAR 1982 AUTHORIZATION AND APPROPRIATIONS

[In thousands]

Fiscal year 1981–82 authorization structure	Fiscal 1982	
	Authorization	Appropriation
Measurement research and standards	$52,577	$49,567
Engineering measurements and standards	24,667	19,450
Computer science and technology	12,263	12,024
Central technical support	24,623	19,138
Technical competence	8,794	7,597
Fire research	1,378	1,391
Core research program for innovation and productivity	18,080	11,111
Total NBS	142,382	120,278

The need for more precise and accurate time information continues to grow. Satellite telecommunication systems, including military communications, navigation systems, and fields of science, such as radio astronomy, are examples of areas having such needs. In response, NBS has recently developed and tested a new time scale measurement system. This system allows significant improvement in the performance of clock measurement equipment. The system uses an NBS invention which won an Industrial Research I–R 100 Award. Tests just completed on the system demonstrate that it is more than 10 times more accurate than previous systems. This new system should prove to be the most effective solution to the common problem of intercomparing three or more clocks. The hardware is available from a commercial vendor and can now come into rapid and widespread use.

Another significant activity during the past year was our investigation of the collapse of two walkways at the Hyatt Regency Hotel in Kansas City. We are preparing to release, this month, a technical report describing the results of our investigation of the collapse. NBS was called upon to perform this investigation because of its reputation for third-party impartiality, its measurement expertise, and its recognized competence in the field of structural engineering. Our assistance was first requested on July 20, 1981, three days after the collapse, by Senator Eagleton. On July 22, 1981, Mayor Berkley formally requested that NBS independently ascertain the most probable cause of the collapse of the Hyatt Regency walkways. Shortly thereafter, in a letter to Mayor Berkley, Senators Eagleton and Danforth and Congressman Bolling endorsed the Mayor's request for NBS assistance. Mr. Winn, the ranking minority member of your parent Committee, also contracted NBS and sent one of his staff to the NBS Center for Building Technology to review building failure investigation practices in the U.S. and other developed countries. Our report will be limited to the technical reasons for the collapse.

AUTHORIZATION REQUEST

As you know, Mr. Chairman, the enactment of an authorization of appropriations for the activities of NBS is needed for fiscal year 1983 and beyond. On February 8, simultaneously with delivery of the President's fiscal year 1983 Budget, the Secretary of Commerce submitted draft legislation which would if enacted authorize appropriations for NBS and the National Technical Information Service (NTIS) for fiscal years 1983 and 1984. A copy of that draft bill, an accompanying Statement of Purpose and Need, and letters of transmittal to the Speaker of the House and the President of the Senate are attached. We could not submit these documents to the Congress until the President had submitted his Budget.

Section 2 of our draft bill if enacted would authorize a total NBS appropriation, exclusive of funding for salary adjustments, of $104,362,000 for fiscal year 1983. This includes $49,980,000 for Measurement Research and Standards, $32,872,000 for Engineering Measurement and Standards, and $21,510,000 for Central Technical Support.

The request for NBS does not include authorization of appropriations for the NBS Institute for Computer Sciences and Technology (ICST). The Administration is proposing to transfer ICST to the General Services Administration (GSA) in fiscal year 1983, and funding for the activities of ICST is included in GSA's budget request. Shortly, the Secretary of Commerce and the Administrator of General Services will jointly submit legislation for consideration by the Congress to vest the Secretary's responsibilities for automatic data processing and computer-related research and

data processing standards setting with the Administrator. This will place the Government's entire automatic data processing program with the Administrator who now has most of it. If Congress approves the transfer of the Secretary's functions, ICST will be transferred to the Administrator. The Administrator, under section 603(a) of the Federal Property and Administrative Services Act of 1949, has a continuing authorization of appropriations for activities of this type. Thus, no specific authorization of appropriations will be required.

I would now like to point out several changes in the budget request for NBS for fiscal year 1983.

NBS' budget request includes direct support for most of NBS' fire research activities. In the recent past the largest portion of this funding has been appropriated to the Federal Emergency Management Agency (FEMA) and then passed through to NBS. The fiscal year 1983 budget includes a transfer of funding estimates from the FEMA budget to NBS.

We are requesting program decreases in several areas consistent with the Administration's desire to hold down Federal spending. The factors considered in the identification of these areas were: minimum disruption to our core research programs through Reduction in Force, availability of feasible alternatives to accomplish program goals, and relative priority within NBS.

Our Environmental Measurements Program, which has been involved with long-term research toward the development of techniques for measurement of chemicals introduced in the environment, will not be continued in fiscal year 1983. $226,000 was provided for the program in fiscal year 1982. We expect that EPA will provide industry and government agencies with the necessary technical data and assistance.

Our Competence Building Program for development of the Bureau's basic scientific competencies for the future has been reduced by $1 million in fiscal year 1983. This is in fact elimination of the expansion of $1 million approved in fiscal year 1982. We were able to effectively use the 1982 funds to equip several projects that will be continued with ongoing resources.

Our recycled materials program has been concerned for several years with identification and investigation of technical problems encountered in the recovery and reuse of waste materials. The major objectives of the program have been achieved to the point where it is now appropriate for the private sector to continue further efforts to satisfy their specific requirements. This makes possible a $3.1 million reduction in our request for fiscal year 1983.

We are also reducing our direct funding for research on the properties of new-process metals and on automated manufacturing. Both of these reductions are to increases approved in fiscal year 1982 and in both cases we were able to use the 1982 money to establish a capability which could be continued with lower levels of appropriated funds. Other agency funding and cooperation with the private sector make these reductions possible.

The amount requested for acquisition of an upgraded NBS computer, which was initially funded at the $9.3 million level in fiscal year 1982, has been reduced by $5.6 million to $3.7 million for fiscal year 1983. In this case, we have evaluated leasing versus outright purchase of certain system components and are confident that the lease option will permit us to move ahead with the acquisition of the computer capability we need, but at a lower annual cost.

Section 4 of our draft bill provides an authorization of appropriations of such sums as may be necessary for each of fiscal years 1983 and 1984 to make salary adjustments. Section 5 would make appropriations authorized by the bill available for obligation, for expenditure, or for obligation and expedition for whatever period is so specified in the Acts making the appropriation.

I will not discuss section 3 of our draft bill. This section would authorize appropriations for the National Technical Information Service (NTIS). NTIS is not part of NBS, but is subject to reauthorization by this Subcommittee. Dr. Joseph Caponio, Acting Director of NTIS, will testify in support of that section tomorrow.

INTERNATIONAL ACTIVITIES

Mr. Chairman, before concluding I would like to discuss the results of amendments to the Organic Act affecting our international activities which were made by this Subcommittee as part of our last reauthorization. The NBS Authorization Act for fiscal years 1981 and 1982 amended the NBS Organic Act to provide the Secretary with expanded authority for NBS' participation in international activities. This new authority allowed the Secretary to use appropriated funds and other forms of assistance such as fellowships to defray the expenses of foreign scientists while they are performing scientific work at NBS of mutual interest and benefit. During the

calendar year 1981, 32 guest workers were assisted under this new authority. These workers delivered 208 man-months of research effort to NBS that would not have been otherwise available. Because of the cost-sharing with the guest workers' home agencies, their services cost NBS only about one-eighth as much as would be required for payment in full.

Another amendment to our Organic Act permits NBS employees to accept remuneration from foreign governments for their air transportation and subsistence expenses while working in foreign laboratories. During 1981 NBS received reimbursements and fellowships which amounted to about $135,000 and resulted in important communications with foreign scientists that NBS would not have had otherwise.

Mr. Chairman, the amendments to our Organic Act made as part of our last authorization have been and will continue to be most beneficial to NBS; they will help us to maintain a current awareness of new developments at the forefront of science and technology on a worldwide basis. The Subcommittee showed commendable foresight in obtaining their enactment.

While on the subject of international activities, I would note that NBS in August 1981 entered into an agreement with the U.S. Agency for International Development. Under that agreement NBS will provide technical assistance to the Egyptian National Institute of Standards and the Egyptian Organization for Standardization and Quality Control. The objective of this effort is to enhance the abilities of these organizations to provide services for protection of the health and safety of the Egyptian people and to promote Egyptian manufacture of high quality products that will meet international standards.

NBS cooperation with its counterparts in the People's Republic of China (PRC) is also increasing. In May 1979, an agreement was signed between the Department of Commerce and the PRC State Bureau of Metrology (SBM) for cooperation in measurement and standardization. Under this agreement, we have embarked on a five-year program of cooperation between NBS and SBM. Thus far seven Chinese scientists have carried out research projects in NBS laboratories and seven NBS technical experts have gone to China to deliver lectures and visit laboratories. The technical fields in which these scientists have worked include electrical measurements, optical measurements, ionizing radiation measurements, standard reference materials, and analytical chemistry.

AREAS OF SUBCOMMITTEE CONCERN

I would now like to discuss a number of areas which have been of special interest and concern to the Members of this Subcommittee.

First, I will review the Reduction In Force (RIF) situation at NBS. As you know, NBS like most Federal agencies has been required to reduce its overall personnel ceiling. Specifically a reduction of 369 positions was to be achieved at NBS by the end of fiscal year 1982. Of this total a reduction of 108 positions was achieved under a 2 for 1 hiring freeze. A reduction of an additional 97 positions is being achieved through attrition and retirement. The remaining reduction of 164 is being achieved through a Reduction in Force which began in the spring of 1981.

To minimize the hardship on the affected employees, we conducted a job assistance program throughout the RIF process. About 60 percent, or 160, of the employees who were displaced participated in the program, as did 76 percent of the employees who were separated for reasons other than retirement. This was an extremely successful program, and I intend to continue it for the time being.

In fscal year 1982 we are reducing no technical positions supported by appropriations to the Secretary for the conduct of Bureau activities. However, we are conducting a RIF of about 40 overhead positions. This action is being taken partly in response to the Secretary's goals of reducing the cost of overhead and support functions, and partly through my own recognition of the need to reduce overhead costs charged to our direct technical programs.

With regard to our efforts toward upgrading of NBS' computing capability, a contract for a transition computer has been signed and delivery of a UNIVAC 1100/82 is scheduled for delivery this month. A Request For Procurement (RFP) for a computer to replace NBS' main computer was released in December 1981. The schedule for procuring the replacement computer calls for proposals responding to the RFP to be returned to NBS by March 1982. Contract award is scheduled for September 1982, with delivery scheduled for 1983. NBS will run its scientific computing on the UNIVAC 1100/82 transition computer until early fiscal year 1984 when the replacement computer is expected to be fully operational. The 1100/82 will continue to be used for NBS administrative computing and for other DOC computer requirements. The schedule may slip, however, because Congressman Brooks has requested a brief,

60-day study by the General Accounting Office of the planned requisition of scientific computers by NBS and NOAA to see if economies may be affected by some form of consolidation.

In response to the Earthquake Hazards Reduction Act of 1977, we are continuing our work on the earthquake resistance of buildings. We expect to provide information to the public and private sectors for their use in amending building codes to improve building resistance to earthquakes. Our FY 1983 budget request contains $475,000 for our earthquake hazards reduction program.

As a result of the Subcommittee's June 1981 hearing to determine if there is a need to revise NBS' Organic Act, we have been engaged in an extensive and detailed review of that Act. Secretary Baldrige promised at the June hearing that he would submit his legislative recommendations regarding NBS to the Subcommittee by early this year. We expect to transmit our recommendations in the near future.

CONCLUSION

Mr. Chairman, NBS has undergone some significant changes during the past two years since our last reauthorization. In recognition of the critical role of the National Bureau of Standards to the economic well-being of the country, Secretary Baldrige has directed that I report directly to him and not through an intermediate management layer. Thus, I will function in a role commensurate to that of an Assistant Secretary of Commerce. This upgrading reflects the enhanced stature and responsibility of the Bureau within the framework of the Department of Commerce.

While NBS by the end of fiscal year 1983 will have undergone significant reductions in both staff and programs, I believe that our general level of accomplishment has been and will remain outstanding. I look forward to working with your Committee toward greater achievements in the future. Mr. Kammer and I will be pleased to answer any questions you may have.

THE SECRETARY OF COMMERCE,
Washington, D.C.

Hon. THOMAS P. O'NEILL, Jr.,
Speaker of the House of Representatives,
Washington, D.C.

DEAR MR. SPEAKER: Enclosed are six copies of a draft bill to authorize appropriations to the Secretary of Commerce for the programs of the National Bureau of Standards for fiscal years 1983 and 1984, and for other purposes together with a statement of purpose and need in support thereof for consideration by the House of Representatives.

We have been advised by the Office of Management and Budget that submission of this legislation to the Congress and its enactment would be consistent with the Administration's program.

Sincerely,

____ ____,
Secretary of Commerce.

Enclosures.

THE SECRETARY OF COMMERCE,
Washington, D.C.

Hon. GEORGE BUSH,
President of the Senate,
Washington, D.C.

DEAR MR. PRESIDENT: Enclosed are six copies of a draft bill to authorize appropriations to the Secretary of Commerce for the programs of the National Bureau of Standards for fiscal years 1983 and 1984, and for other purposes, together with a statement of purpose and need in support thereof for consideration by the Senate.

We have been advised by the Office of Management and Budget that submission of this legislation to the Congress and its enactment would be consistent with the Administration's program.

Sincerely,

____ ____,
Secretary of Commerce.

Enclosures.

A BILL To authorize appropriations to the Secretary of Commerce for the programs of the National Bureau of Standards for fiscal years 1983 and 1984, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Bureau of Standards Authorization Act for Fiscal years 1983 and 1984".

AUTHORIZATION FOR PROGRAM ACTIVITIES

SEC. 2. There are authorized to be appropriated to the Secretary of Commerce to carry out activities performed by the National Bureau of Standards for the following line items:

(a) Measurement Research and Standards, $49,980,000 for fiscal year 1983, and such sums as may be necessary for fiscal year 1984;

(b) Engineering Measurements and Standards, $32,872,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984; and

(c) Central Technical Support, $21,510,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984.

NATIONAL TECHNICAL INFORMATION SERVICE

SEC. 3. In addition to the sums authorized to be appropriated by section 2 of this Act, there are authorized to be appropriated to the Secretary of Commerce $1,980,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 to carry out activities performed by the National Technical Information Service.

SALARY ADJUSTMENTS

SEC. 4. In addition to the sums authorized to be appropriated by sections 2 and 3 of this Act, there are authorized to be appropriated for each of the fiscal years 1983 and 1984 such additional sums as may be necessary to make any adjustments in salary, pay, retirement, and other employee benefits which may be provided for by law, and, if the full amount necessary to make such adjustments is not appropriated, the adjustments shall be made proportionately from section 3 and from the line items in section 2 in a manner reflecting the extent to which the amount of section 3 and of each line item in section 2 is attributable to employee benefits of the type involved.

AVAILABILITY OF APPROPRIATIONS

SEC. 5. Appropriations made under the authority provided in this Act shall remain available for obligation, for expenditure, or for obligation and expenditure for periods specified in the Acts making such appropriations.

STATEMENT OF PURPOSE AND NEED

The National Bureau of Standards (NBS), the Nation's oldest national laboratory and lead agency for measurement science and standards, was created by the Act of March 3, 1901 (Public Law No. 56-177; 15 U.S.C. 271-278h) (hereinafter cited as the "Organic Act" or "Act"). Pursuant to that Act, the Secretary of Commerce is authorized to undertake certain functions including: the custody, maintenance, and development of the Nation's standards of physical measurement and provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods for testing materials, mechanisms, structures, supplies and equipment; cooperation with other Federal agencies and the private sector in the establishment of standard practices; the provision of advisory services to government agencies on scientific and technical problems; and the invention and development of devices to serve special national needs.

Since its creation in 1901, and until fiscal year 1979, the Organic Act served as a continuing authorization of appropriations for Organic Act activities. In 1978, the Congress in Public Law No. 95-322 amended section 18 of the Organic Act (15 U.S.C. 278h) to limit to fiscal years 1979 and 1980 the period for which appropriations under the Act were authorized. In 1980, the Congress in Public Law No. 96-461 repealed that amendment thus restoring the continuing authorization of appropriations for Organic Act activities. However Public Law No. 96-461 also limited to

fiscal years 1981 and 1982 the authorization of appropriations for all of NBS' activities and operations including those performed under the Organic Act and under other statutes such as the Standard Reference Data Act (15 U.S.C. 290–290f) and section 5(d) of the Earthquake Hazards Reduction Act of 1977 (42 U.S.C. 7704(d)). Public Law No. 96–461 also specifically included an authorization of appropriations limited to fiscal years 1981 and 1982 for those activities of the National Technical Information Service (NTIS) which are funded by appropriations. The primary purpose of this bill is to extend through fiscal years 1983 and 1984 the authorization of appropriations for the Bureau and NTIS.

Section 2 authorizes appropriations to the Secretary of Commerce to carry out the following line item activities of the National Bureau of Standards: $49,980,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 for Measurement Research and Standards; $32,872,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 for Engineering Measurements and Standards; and $21,510,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 for Central Technical Support. These items include NBS' Organic Act activities (including fire research activities conducted under the authority of amendments to the NBS Organic Act made by section 18 of the Federal Fire Prevention and Control Act of 1974) and NBS' activities under other statutes such as the Standard Reference Data Act and section 5(d) of the Earthquake Hazards Reduction Act of 1977.

Section 3 authorizes appropriations for the National Technical Information Service. The Act of September 9, 1950 (64 Stat. 823–824; 15 U.S.C. 1151–1157) directed the Secretary of Commerce to establish a clearinghouse for the collection and dissemination of scientific, technical and engineering information. The Secretary established, within the National Bureau of Standards (NBS), the Clearinghouse for Federal Scientific and Technical Information to perform the clearinghouse function. Later, through issuance of Department Organization Order 30–7A in September 1970, the Secretary created a new operating unit of the Department of Commerce, the National Technical Information Service (NTIS), and reassigned the clearinghouse function to it.

NTIS is the central source for the public sale of research, development and engineering reports and other analyses prepared by Government agencies, their contractors and grantees, and selected non-Governmental entities. It is also the central source for sales of Government-generated computer-processable data files. Pursuant to Section 3 of the Act of September 9, 1950 (15 U.S.C. 1153), NTIS sells its products and services on a self-sustaining basis. Gross sales are about $22 million annually. Eighty-five percent of revenues come from sales to the public; the remainder derives from sales to Government agencies.

NTIS also performs a few activities funded by appropriations. The Congress in Public Law No. 96–461 authorized appropriations for these activities of the National Technical Information Service for fiscal years 1981 and 1982 and to pay the first year costs of a two-year program to modernize NTIS's computer system. Section 3 of this bill authorized the appropriation to the Secretary of Commerce of $1,980,000 for fiscal year 1983 and such sums as may be necessary for fiscal year 1984 to carry out those programs and activities of NTIS which are funded by appropriations and to pay the second (final) year costs of the two-year NTIS computer system modernization program.

Section 4 authorized the appropriation of such additional sums as may be necessary to make any adjustments in salary, pay, retirement, and other employee benefits which may be provided for by law. If the full amount necessary to make such adjustments is not appropriated, then section 4 provides that the adjustments be made proportionately from section 3 and from the line items in section 2 in a manner reflecting the extent to which the amount of section 3 and of each line item in section 2 is attributable to employee benefits of the type involved.

Section 5 provides that appropriations made under the authority provided in this Act shall remain available for obligation, for expenditure, or for obligation and expenditure for periods specified in the Acts making such appropriations. The final determination whether to limit the availability of an appropriation to a single year or on a multiple-year basis is made when an appropriation bill is enacted by the Congress. An appropriaton bill providing for other than a single-year availability would be subject to a point of order if an authorizing statute had not previously been enacted. Section 5 of this bill provides this necessary authority. In addition most research and development organizations are subject to uncertainties inherent in research programs, to a high incidence of unpredictable factors that compel the readjustment of program activities, and to the need for flexibility to permit prompt

response to changed circumstances. Section 5 also provides for this necessary flexibility for the scientific and engineering research programs of NBS.

Mr. WALGREN. I would like to proceed with the statement of the other witnesses from the Bureau at this point, and then we will return. Who is next? Dr. Hoffman?

[A biographical sketch of Dr. Hoffman follows:]

DR. JOHN D. HOFFMAN, DIRECTOR, NATIONAL MEASUREMENT LABORATORY, NATIONAL BUREAU OF STANDARDS

Dr. John D. Hoffman was born in Washington, D.C. in 1922. He was educated at Franklin and Marshall College (B.S. 1942, honors) and Princeton University (Ph D. 1949, physical chemistry). He resides in Bethesda, Maryland, with his wife and three sons. Principal sports: hunting and hiking, mostly on his farm in Pennsylvania. He served in World War II, and was awarded the Soldier's Medal decoration. After 5 years industrial laboratory experience with the General Electric Company, he joined the NBS staff in 1954. From 1968 to 1978, Dr. Hoffman was Director of the Institute for Materials Research; and then in 1978, he was appointed Director of the National Measurement Laboratory. Dr. Hoffman is the author or co-author of about 50 scientific papers, mainly on dielectric phenomena and polymer physics. He has served as an adjunct professor (polymer physics) at the University of Maryland. He received the Gold Medal Award of the Department of Commerce in 1965, and was awarded the High Polymer Physics Prize of the American Physical Society in 1971. He is on the editorial board of several scientific journals and has served on the Board of Trustees of the American Society for Testing and Materials (ASTM) and the Gordon Research Conferences (Chairman, 1976–77).

Dr. Hoffman is a Fellow of the American Physical Society, a member of a number of scientific societies, including the American Chemical Society and the New York Academy of Sciences. He is an honorary member of the American Dental Association.

STATEMENT OF DR. JOHN D. HOFFMAN, DIRECTOR, NATIONAL MEASUREMENT LABORATORY, NATIONAL BUREAU OF STANDARDS

Dr. HOFFMAN. Thank you.

Mr. Chairman and members of the subcommittee, it is a distinct privilege to appear before you as Director of the National Measurement Laboratory to describe our measurement research and standards work at the National Bureau of Standards. I have submitted a slightly longer written statement, and respectfully request this be entered in the record.

Mr. WALGREN. It will be so.

Dr. HOFFMAN. The National Measurement Laboratory is responsible for the development and dissemination of our national physical and chemical standards of measurement at a level of accuracy sufficient to meet the needs of science, industry, commerce, and Government. This is a multifaceted responsibility that requires scientific competence and experimental facilities capable of dealing with state-of-the-art measurement at virtually all areas of physical and chemical science from nuclear physics to chemical analysis.

We are also responsible for the characterization of properties and performance of materials and the behavior of complex chemical systems encountered in such applications as materials processing, chemical manufacturing, and the environment. We develop, produce, and distribute standard reference materials and carry out the provisions of the Standard Reference Data Act.

In all of these areas we provide advisory and research services to other Government agencies. In a sense, we are a central research laboratory for measurement science in the Federal Government.

Our work in measurement methods, standards, and data is widely used by U.S. industry. We provide key measurement services in support of industrial enterprise. Examples are: first, product quality control through nondestructive evaluation; and, second, materials selection and substitution. Other key measurement services relate to protection of the worker from harmful effects of radiation, standards and methods for accurate clinical analysis, and photometry.

The National Measurement Laboratory has a staff of 860 onboard, full-time career employees, plus another 565 in such categories as industrial research associates, guest workers, student trainees, and temporary employees. Based on the funding level contained in the third continuing resolution, our fiscal year 1982 budget is $55 million appropriated for scientific and technical research services. We expect to receive another $33 million for reimbursable services, including services to other agencies, sales of standard reference materials, and calibration services.

To give you a more concrete picture of the work we are doing, let me now give some specific examples of our recent accomplishments in the development of measurement technology in a variety of areas. During the past year, for example, we have: First, devised a scale of incinerability for use in the destruction of hazardous organic wastes by incineration and in the control of their production during combustion; second, completed a compendium of important thermodynamic data. Over 14,000 substances are covered. This compilation is used throughout the technical and scientific communities; third, developed a new standard that will be used to calibrate radiation-producing apparatus used in cancer therapy; fourth, established a practice technique for chemical analysis of ultra-trace quantities of toxic but industrially important metals; fifth, developed a new electrochemical technique to investigate corrosion on metal surfaces that are under organic films that are used as corrosion-resistant coatings. This will provide information for improving such coatings; sixth, developed crack growth tests for structural metals in order to evaluate their suitability in important materials such as those used in real structures; seventh, chemically characterized and certified a new human serum standard reference material for use in clinical diagnostics. This includes certification of six constituents that are commonly measured in clinical laboratories to aid diagnosis; eight, developed a new instrument that not only extends the range of accurate pressure measurement by two orders of magnitude but also greatly improves the speed and ease of the measurements. This instrument has enabled NBS to offer a new calibration service. It has application to large-demand, high-accuracy measurement problems such as occur in aircraft altimetry.

Permit me now to discuss future thrusts. The National Measurement Laboratory has done cutting-edge work in gas phase chemistry, and our extensive catalog of standards reference materials for gas analysis as well as our record of publications in the scientific literature is testimony to this fact. We now see major measurement problems in condensed-phase chemistry, that is, solution and liquid-state chemistry, and plan to shift our efforts in that direction.

The lack of kinetic and thermodynamic data for reactions in solution is one factor that prompts us to enter this new area of chemistry. These data will permit a more fundamental and therefore more meaningful characterization of chemical processes and properties in the liquid state. The measurement methods, data, and standards established in this effort will find application in major areas of industry.

Metals processing research has a central role in our materials science program. The properties of alloys depend on their processing history. In fiscal year 1982 we have been able to expand our program in materials science in two new metals processing methods. The first is rapid solidification, in which strength, toughness, and corrosion resistance of metals can be increased. The second is alloy coating, where a variety of special surface properties can be produced. Our role in the development of these new technologies lies in providing data measurement techniques and theory and predictive models that can be used to relate the properties of an alloy to the conditions under which it has been processed.

In addition to condensed phase chemistry measurements and metals processing, a third area of particular concern is ionizing radiation. The increasing application of ionizing radiation in industry and its potential impact on employees and the public have raised concerns about the accuracy and consistency of radiation measurements.

The goal of our program is to improve the measurement of ionizing radiation in order to assure public health and safety and to do so in a manner not detrimental to industry. Three essential components of the proposed program are: first, intermediate calibration laboratories that will link field measurements to NBS; second, additional national measurement standards; and, third, research on advanced measurement concepts and techniques. Our efforts in this program will not only enhance public safety and health but also reduce the economic burdens on industry that result from inadequate measurements.

Let me now enter a few comments about our cooperative programs with U.S. industry. As Dr. Ambler testified, we aim to double the size of the Industrial Research Associates Program at the Bureau of Standards from about 100 to 200. This program is an effective technology transfer mechanism.

For example, we have had an ongoing program with the American Dental Association for many years. Research associates from the American Dental Association are working with NBS scientists on physical-chemical programs for preventive dental treatment, and on the development of adhesive procedures for binding dental resins to the dentin component of teeth.

Let me now discuss our planned changes for fiscal year 1983. We plan to discontinue our recycled materials program, which is funded at $3.1 million for fiscal year 1982. The recycled oil portion of the program, which is $1.2 million, achieved its major objectives to the point where the private sector can take over further efforts to satisfy their specific requirements. Methodology for establishing heating values for recycled oil has been developed.

Information developed from recycling used engine oils has significantly assisted the re-refining industry in the determination of

the most efficient processes for re-refining. The resource recovery portion of the program, $1.9 million, has produced information that will aid materials recyclers, buyers of recycled materials, producers of goods containing recycled materials, public and private purchasers, and the public.

A $3 million reduction in the direct funding of the metals processing program is requested for fiscal year 1983. The 1982 increase will be used to establish a high-quality research facility for rapid solidification and alloy coating techniques. In fiscal year 1983 the funding of this program will largely be through support from industry and other Federal agencies. NBS will conduct a joint program on phase diagrams with the American Society for Metals, using university and industrial research associates.

In conclusion, I wish to say that we are dedicated to serving the Nation in the areas of measurement methods, standards, and data. We stand ready to act as a third party in technical disputes and to provide facts to assist those who must make technical and scientific decisions. To do this, we must manage well and never let our quality be compromised.

Thank you.

[The prepared statement of Dr. Hoffman follows:]

STATEMENT BY
DR. JOHN D. HOFFMAN
DIRECTOR
NATIONAL MEASUREMENT LABORATORY
NATIONAL BUREAU OF STANDARDS

BEFORE THE

SUBCOMMITTEE ON SCIENCE RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES
FEBRUARY 9, 1982

Mr. Chairman and members of the subcommittee, it is a privilege to appear before you as Director of the National Measurement Laboratory to describe our measurement research and standards work at the National Bureau of Standards.

NATIONAL MEASUREMENT LABORATORY OVERVIEW

The National Measurement Laboratory is responsible to the nation for the development and dissemination of the national physical and chemical standards of measurement at a level of accuracy sufficient to meet the needs of science, industry, commerce, and government. This is a multifaceted responsibility that requires scientific competence and experimental facilities capable of dealing with state-of-the-art measurement in virtually all areas of physical and chemical science from nuclear physics to chemical analysis. We are also responsible for the characterization of properties and performance of materials and the behavior of complex chemical systems encountered in such applications as materials processing, chemical manufacturing, and the environment. We develop, produce, and distribute standard reference materials and carry out the provisions of the Standards Reference Data Act. In all these areas we provide advisory and research services to other government agencies. We are a central laboratory for measurement science in the Federal government.

Our work in measurement methods, standards, and data is widely used by U.S. industry. We provide key measurement services in support of the industrial enterprise. Examples are: (1) product quality control through non-destructive evaluation; and (2) materials selection and substitution. Other key measurement services relate to protection of the worker from harmful effects of radiation, and standards and methods for accurate clinical analysis, and photometry.

The National Measurement Laboratory has a staff of 860 on board full-time career employees, plus another 565 industrial research associates, guest workers, student trainees, part-timers, and temporary employees. Based on the funding level contained in the Third Continuing Resolution, our FY 82 budget is $55 million appropriated for scientific and technical research services and $33 million for reimbursable services, including services to other agencies, sales of standard reference materials, and calibration services.

RECENT ACCOMPLISHMENTS

To give you a more concrete picture of the work we are doing, let me now give some specific examples of our recent accomplishments in the development of measurement technology in a variety of different areas. During the past year, we have for example:

- Built a surface science laboratory where we can look at the fundamental chemical interactions that take place between the atoms of a gas and the atoms on a solid surface substrate. This kind of basic information is essential for the understanding and development of catalysts.

- Devised a scale of incinerability for use in the destruction of hazardous organic wastes by incineration and in the control of their production during combustion.

- Completed a compendium of important chemical data. Over 14,000 substances are covered. This compilation is used throughout the technical and scientific communities.

- Developed a new standard that will be used to calibrate radiation-producing apparatus used in cancer therapy.

- Developed a reliable analytical technique for determination of light elements in materials such as biological tissues, coal, and synthetic fuels.

- Established a practical analytical technique for analysis of ultra-trace quantities of toxic but industrially important metals.

- Developed a new electrochemical technique to investigate corrosion on metal surfaces under organic films that are used as corrosion resistant coatings; this will provide information for improving such coatings.

- Developed crack growth tests for structural metals in order to evaluate their suitability in important materials such as those used in bridges and airplanes.

- Initiated development of models for the migration of additives in high-volume commercial polymers, such as polyethylene, leading to the design of plastic materials for long-term durability in critical applications.

- Characterized and certified a new Human Serum Standard Reference Material for use in clinical diagnostics. This includes certification of six constituents that are commonly measured in clinical laboratories to aid diagnosis of a variety of diseases.

- Developed a new instrument that not only extends the range of accurate pressure measurement by two orders of magnitude but also greatly improves the speed and ease of measurements. This instrument has enabled NBS to offer a new calibration service and is being acquired by two other major standards laboratories for use in calibration programs. It also has application to other large demand, high accuracy measurement problems such as aircraft altimetry.

FUTURE THRUSTS

The National Measurement Laboratory has done cutting-edge work in gas phase chemistry, and our extensive catalog of standard reference materials for gas analysis as well as our record of publications in the scientific literature is testimony to that fact. We now see major measurement problems in condensed phase chemistry and plan to shift our efforts in that direction. The lack of kinetic and thermodynamic data for reactions in solution is one factor that prompts us to enter this new area of

chemistry. These data will permit a more fundamental and, therefore, more meaningful characterization of chemical processes and properties in the liquid state. The measurement methods, data, and standards established in this effort will find applications in major areas of industry.

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In addition to condensed phase chemistry measurements and metals processing, a third area of particular concern is ionizing radiation. The increasing application of ionizing radiation in industry, and its potential impact on employees and the public, have raised concerns about the accuracy and consistency of radiation measurements. The goal of our program is to improve the measurement of ionizing radiation in order to assure public health and safety, and to do so in a manner not detrimental to industry. Three essential components of the proposed program are: (1) intermediate calibration laboratories that will link field measurements to NBS,

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(2) additional national measurement standards, and (3) research on advanced measurement concepts and techniques. Our efforts in this program will not only enhance public safety and health but can also reduce the economic burdens on industry that result from inadequate measurements.

COOPERATIVE PROGRAMS

Let me add a few comments about our cooperative programs with U.S. industry and universities. As Dr. Ambler testified, we aim to double the size of the Industrial Research Associate Program at NBS from 100 to 200. This program is an effective technology transfer mechanism. For example, we have had an ongoing program with the American Dental Association (ADA) for many years. Research Associates from the ADA are working with NBS scientists on physical-chemical programs for preventative dental treatment and on the development of adhesive procedures for binding dental resins to the dentin component of teeth.

FY 83 CHANGES

We plan to discontinue our recycled materials program ($3.1M) in 1983. The recycled-oil portion ($1.2M) of the program achieved its major objectives to the point where the private sector can take over further efforts to satisfy their specific requirements. Methodology for establishing heating values for recycled oil has been developed. Information developed for recycling used engine oils will significantly assist the re-refining industry in the determination of the most efficient processes for re-refining. The resource-recovery portion ($1.9M)of the program will have

developed information that will aid material recyclers, buyers of recycled materials, producers of goods containing recycled materials, public and private purchasers, and the public.

A $3 million reduction in the direct funding of the metals processing program is requested for fiscal year 1983. The 1982 increase will be used to establish a high quality research facility for rapid solidification and alloy coating techniques. In FY 1983 the funding of this program will largely be through support from industry and other federal agencies. NBS will conduct a joint program on phase diagrams with the American Society for Metals, using university and industrial Research Associates.

By the end of FY 1982, the Environmental Measurements Program will have developed sufficient scientific capabilities to meet the short-term measurement needs of other Federal agencies. We will eliminate measurement research in this area with a savings of $226K. These activities are the responsibility of the Environmental Protection Agency.

CONCLUSION

We are dedicated to serving the nation in the areas of measurement methods, standards, and data. We stand ready to act as a third party in technical disputes, and to provide facts to assist those who must make technical and scientific decisions. To do this, we must manage well, and never let our quality be compromised.

Mr. WALGREN. Thank you, Dr. Hoffman.
Dr. Lyons?
[The biographical sketch of Dr. Lyons follows:]

JOHN W. LYONS

Date of Birth: November 5, 1930

Birthplace: Reading, Massachusetts

Education: Degrees

Harvard University, A.B., Chemistry
1952
Washington University, A.M., Physical Chemistry
1963
Washington University, Ph.D., Physical Chemistry
1964

Position:

Director
National Engineering Laboratory
National Bureau of Standards

As Director of the National Engineering Laboratory, Dr. Lyons is responsible for NBS's research in applied mathematics, building technology, electronics and electrical engineering, energy conservation, engineering standards development, fire, manufacturing engineering, and chemical engineering.

Dr. Lyons was Director of the NBS Center for Fire Research until December 18, 1977, and was responsible for providing scientific and technical knowledge applicable to the prevention and control of fires.

Dr. Lyons served in various research and development positions at the Monsanto Company from 1955 to 1973. He specialized in the chemistry and uses of phosphorus-based chemicals including fire retardants. He served from 1971 to 1973 as a member of the ad hoc panel of fire research, a National Academy of Sciences evaluation panel for the National Bureau of Standards.

Dr. Lyons is author of two books: Viscosity and Flow Measurement and The Chemistry and Uses of Fire Retardants. He has contributed chapters to five other books and has written numerous papers and articles on technical or research topics. His early research interest was the physical chemistry of polyelectrolyte solutions, especially formation of complexes with metal ions. This work emphasized the behavior of inorganic polyphosphates and desoxy ribonucleic acid (DNA).

Dr. Lyons is a Fellow of the American Association for the Advancement of Science, Fellow of the Washington Academy of Science, member of the American Chemical Society (past chairman of the St. Louis Section), member of the American Institute of Chemical Engineers, and member of Sigma Xi. He serves on the Advisory Committee for Engineering, National Science Foundation; Advisory Council, College of Engineering, University of Maryland; Board of Directors, National Fire Protection Association. He was chairman of the Products Research Committee (1974-1979), a nine-member charitable trust administering a $5M research fund on fire research; co-chairman of the US-Japan National Resources Panel of Fire Research (1975-1978). He received the Presidential Management Improvement Award in 1977 and the U.S. Department of Commerce Gold Medal, also in 1977. In 1981 he received the Presidential Rank Award of Distinguished Executive.

STATEMENT OF DR. JOHN W. LYONS, DIRECTOR, NATIONAL ENGINEERING LABORATORY, NATIONAL BUREAU OF STANDARDS

Dr. LYONS. Thank you, Mr. Chairman.

It is a pleasure once again to appear before this subcommittee to discuss the programs of the National Engineering Laboratory. I have a detailed written statement which I should like to submit for the record.

Mr. WALGREN. You may do so.

Dr. LYONS. I will summarize.

The National Engineering Laboratory develops engineering data, new measurement procedures, performs calibrations, develops test methods, and conducts research in support of these efforts. Our major program thrusts are electronics and electrical engineering; manufacturing engineering, including our automation program; chemical engineering; building research; fire research; and applied mathematics, including scientific computing. We conduct measurement services which cut across all of these programs.

Let me now address some major changes that have occurred in the National Engineering Laboratory since my last appearance before this subcommittee 2 years ago. First, we split the program on mechanical engineering and process technology into two parts—automation and chemical engineering. As Dr. Ambler has testified, we received an increase for the automation program, and I will return to that in a moment.

Second, we have strengthened the scientific computing work at the Bureau of Standards, both in terms of staff and in terms of hardware, especially the network which connects our computers.

Third, we have had an increase in our VLSI, and I am pleased to report that this program is up and running.

Fourth, as Dr. Ambler noted, we now have direct funding for the Center for Fire Research, all in the National Bureau of Standards budget as of fiscal year 1983. I will come back to the discussion of the fire research program in my appearance before this body tomorrow.

On the down side, we have abolished the Center for Consumer Product Technology. The remaining work on consumer products will be managed by an office structure and any reimbursable work will be done in other NBS divisions. We have also narrowed the focus and reduced the size of our building research program, primarily because the support from other Federal agencies is declining. Most of the reductions in force in the laboratory came in those two areas, Mr. Chairman.

A word about our measurement services. As I noted, the measurement service work cuts across all of the engineering laboratory's programs. In both calibration and measurement assurance we perform approximately 60 percent of the total NBS work. I regard this as a very important activity on which much of the Bureau's fine reputation rests. These activities are being strongly impacted by new technology, particularly the advent of the microprocessor in laboratory equipment. This is requiring that we provide additional resources, and we are paying very close attention to the health of these services.

Now I would like to make a few comments about each part of our program; the written statement has a great deal more detail. In electrotechnology, I would just take note of a new calibration service that the Bureau offered beginning last spring for analog to digital and digital to analog converter devices, which are essential in the modern era of digital signal processing. What one does is to sample an analog signal very rapidly and digitize that information. Our calibration service keeps such a device at a known level of performance.

Down the road we see such digital signal processing occurring at ever-increasing rates, and it is our firm belief that supercomputers of tomorrow will be operating at the gigahertz cycle times, or a billion operations per second or more. In that regard, we have developed an A/D, 6-bit converter circuit which operates at 2 billion operations per second, which is the world's fastest, and we are zeroing in on one that is two-and-a-half times that fast. Both devices make use of superconducting junction technology.

A second program in the budget is known as the discrete parts technology program. I call it manufacturing engineering, and it comprises classic metrology in force and length and our automated manufacturing program.

In the automation program we seek to provide both the metrology that is required for the factory of the future and the interface standards, particularly with regard to software which will operate and manage the machines and devices on the machine shop floor. Interface standards are particulary necessary when dealing with machines from more than one manufacturer. The required performance is that we must respect the proprietary software in each machine and still couple the machines together.

Congress appropriated $1.5 million for the automated manufacturing research facility in fiscal year 1982 and we are using those funds to plan and to set up the facility. The decrease of $1 million to a level of a half million in fiscal year 1983 will be offset by funds and research associates from the private sector and support from other Federal agencies.

Turning now to chemical process technology or chemical engineering, our function is to serve the chemical and petrochemical industries with evaluated data, with calibration and measurement services, and with basic research information. Just picking one highlight, we have set up a new laboratory for making pressure, volume, and temperature measurements that will go as high as 600 degrees Celsius and 300 atmospheres. This is part of our thermophysical properties program. We have begun working with mixtures of hydrocarbons and plan to turn to other components of such important process streams as synfuels plants.

In building research, we provide the technical basis for codes and standards which are the heart of our building system in the United States. Dr. Ambler mentioned one investigation. Let me mention four which indicate that we have been investigating disasters in buildings for a very long time. First, I remind you of the Baileys Crossroads progressive collapse near Washington, D.C., some years ago; more recently, the Willow Island cooling tower collapse in West Virginia; last spring, a progressive collapse in a condominium at Cocoa Beach in Florida. We completed that investigation early

this fall, and we are just now winding up the writing of our report on the Kansas City Hyatt Regency walkway collapse.

These investigations, besides providing local governments and local officials with a very much needed service, also provide us with guidance for our own research efforts. One thing that is clear from several of these disasters is the need for a better understanding of the rate of setting of concrete, a need to be able to sense this and to predict it so that one takes the forms off at the right moment. Such work is now underway in our Center for Building Technology as a result of these investigations.

In our program on fire research and engineering, we do fundamental work; i.e., develop a predictive capability, including mathematical models of fire growth and spread; we develop test methods; and we develop proposals for the voluntary standards and codes communities.

We have made real progress in the last 2 years in our understanding of how soot is formed in flames, in our understanding of the thermal degradation processes that occur within solids as they decompose in the presence of heat to provide the fuel gas which supplies the fire. We have improved our understanding of turbulent fire plumes, of smoldering combustion, and of various mechanisms for ignition.

The mathematical models of fire growth in rooms that I have described before this subcommittee in earlier testimony are coming along nicely. We can now predict the development of temperature in a room versus time to within plus or minus 10 percent, which is good enough for engineering purposes. I am pleased to say that the software for this work is now being adapted so that it may be used across the country more routinely.

Finally, our program in applied mathematics includes numerical analysis and modeling, operations research, statistical services, and computing. In the area of computing, we have formed a new division for scientific computing, staffed with experts in scientific software. They are assembling and have recently published internally a very extensive compilation of scientific computing codes which are available for use by the staff.

Our applied mathematics program is responsible for central computing at the Bureau. It is responsible for the network which ties computers together, and it is also responsible for laboratory automation. The biggest element in the Bureau's computer network is the central processor. As Dr. Ambler just noted, we are now changing from 15-year-old technology to more recent technology. I personally went downstairs this morning and put my hand on the new machine, and I can testify it is there. We do have a request for proposals for a major computer to solve long-term needs of the Bureau, and we are hopeful that that machine will be delivered sometime in 1983 and be brought into full service the following year.

That completes my summarization, Mr. Chairman. Thank you.

[The prepared statement of Dr. Lyons follows:]

STATEMENT OF
DR. JOHN W. LYONS
DIRECTOR
NATIONAL ENGINEERING LABORATORY
NATIONAL BUREAU OF STANDARDS

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

FEBRUARY 9, 1982

Introduction

Mr. Chairman and Members of the Subcommittee: It is a pleasure for me to appear before this Subcommittee to discuss the engineering and applied science programs at the National Bureau of Standards.

The National Engineering Laboratory (NEL) is one of the two major laboratories which carry out the technical programs of NBS. We develop engineering data and new measurement procedures; we provide calibration services and special tests; we develop test methods and propose their adoption by voluntary standards bodies and code groups; and we conduct research in engineering and applied sciences in support of these efforts. Our programs address major national problems the solutions to which are expected to have substantial favorable economic impact. We work on the scientific aspects of these problems and concentrate on those areas where there are technical market-place barriers requiring an independent third party or where individual firms cannot recoup the necessary investment. Projects are selected based on information derived from many sources including the Administration, Congress, technical and professional societies, industrial firms, trade associations, labor and consumer groups and a vast number of individuals who meet with us continually at the Bureau and at professional meetings and at their places of

employment. The result is the following set of programs: electrotechnology (electronics and electrical engineering), discrete part technology (automated manufacturing), chemical process technology, building research, fire research and engineering, and applied mathematical sciences.

The National Engineering Labortory has an on-board staff of 884 full-time permanent-career employees. There are another 210 staff members in the following categories: industrial research associates, guest workers, IPA's, part-time, and full-time temporary employees. Our budget in FY1982 is $34.5M for scientific and technical research services, and we anticipate receiving $37.4M for reimbursable services.

Changes in NEL

Since I last testified before this Subcommittee in February of 1980 there have been several programmatic and budget changes in NEL. I would like to point these out.

First, we have split the mechanical engineering and process technology program into two separate programs - one on automated manufacturing and one on chemical engineering. This was done after considerable study of the industries and the technologies showed that these two areas are of considerable importance to the economy, that the technologies are very different, and that there is a major NBS role in each area. NBS' high priority program on automated manufacturing is moving towards the objectives we have established and reviewed with this subcommittee. The program received an increase of $1.5 million in fiscal year 1982 to continue establishment of the automated manufacturing research facility.

Second, we have recognized the impact of computers both on our laboratory work and on our clients. We have strengthened the applied mathematics program by adding a major group in scientific computing to support the efforts of all NBS scientists and engineers to keep abreast of the new computer capabilities. The Center for Applied Mathematics (CAM) now bears responsibility for managing the central computer, the computer network, and for providing support for laboratory microprocessors and minicomputers. CAM is also responsible for managing the acquisition of new hardware and software for scientific work.

Third, we received a substantial increase in funding for work on very-large-scale integration in electronic circuits (VLSI). The VLSI program is up and running and represents a much-needed reinforced thrust in our electronics program, also a top priority effort.

Fourth, in the 1983 budget all the direct funding for the Center for Fire Research is included in the NBS budget. This includes funds previously included in the FEMA budget for pass-through to NBS. NBS, with this funding, will be able to carry out its activities as authorized by Section 18 of the Federal Fire Prevention and Control Act of 1974.

Fifth, we have had to curtail our efforts in consumer product technology and in building technology. Decisions to de-emphasize portions of these programs were based on available resources, priorities, and the ability of others, particularly in the private sector, to carry out the work. The generic aspects of the consumer product technology work had progressed to the point where other agencies, which are responsible for product safety, can support applications for their specific needs. Also, both programs were heavily

supported by other Federal agencies and that support declined sharply leaving us with the job of cutting back, reshaping organizationally, and retaining only those essential elements supportable with available funds. We have, therefore, proposed in the new budget the elimination of the Center for Consumer Product Technology. The small program remaining in this area will be managed by an office which will conduct programs in various NBS divisions. The building technology program has been pruned to a smaller effort emphasizing structural engineering, building materials, and the various systems contained in buildings.

Measurement Services

Before reviewing the individual program areas, I shall first say a word about an activity that cuts across all of NEL's activities: measurement services. NEL provides about 60%, by dollars, of all calibration services for NBS. We provide measurement services for mass, force, fluid flow, density, humidity, microwave power, antennae, accelerometers, laser power, and electrical metering. The watt hour meter calibration is the basis for ensuring accurate electric utility bills for every home owner or apartment dweller in the U.S. We have the world's artifact standard against which we calibrate the threads for pipes used in drilling oil wells. This calibration service is of growing importance because of the trend to deeper oil wells.

I emphasize this subject because measurement and calibration services are among the most important services NBS provides. The reputation of NBS in measurements rests upon the quality of our calibration services. Because we place such great importance upon these services, we constantly seek to improve

these services and to manage them efficiently so as to fill the highest priority needs of our customers.

In closing my comments on calibration services I would like to point out that this area is rapidly changing and is being impacted by new technology. One of the major factors is the addition of computing capability to measurement instruments and procedures. The ability of such procedures and equipment to make many rapid measurements presents a challenge to our engineering programs as well as to our statistical services. We expect this to be an increasingly important factor in the future and are providing resources to the measurement services groups to keep them up to date.

NEL Programs

I would now like to describe NBS's major programs and some of our most recent major accomplishments.

Electrotechnology

In our work on electronics and electrical engineering we provide three kinds of technical services; namely, calibration and measurement assurance related to national standards, measurement methods and related technology in critical problem areas where individual firms are unable to do the work or unable to justify, individually, the expense; and measurement techniques and services designed to facilitate marketplace transactions where a neutral, technically qualified, third party is required.

In the calibration and measurement sector, high speed and digital signal processing techniques are creating new demands for NBS services. Technical

trends include more use of digital signal processing, optical fiber transmission, and higher data transmission rates. These trends are driven by several developments, the most significant of which is fabrication of interconnected circuit elements on a single chip of silicon at ever smaller dimensions and increasing density of electronic functions. These trends in integrated circuitry have led to a dramatic decrease in the size and the price of digital processors, which together with an increase in speed and complexity, has significantly improved the performance of signal processors.

NBS has initiated a new calibration service for analog-to-digital (A/D) and digital-to-analog (D/A) data converters at data rates now significantly used in commerce. This service, based on a special reference 20-bit D/A converter developed by NEL, marks the entry of NBS into the arena of providing direct calibration support for the analog/digital signal-processing conversion components which are vital elements of modern measurement equipment. A/D and D/A converters, for example, link the real world of analog phenomena to the world of digital computing and data processing. The new calibration service will support a class of devices with an estimated market this year of $600 million.

The new service will support manufacturers and users of A/D and D/A converters in meeting a multiplicity of measurement needs, including testing of individual converters destined for highly demanding applications, satisfying traceability requirements imposed by military or government contracts, independent verification of their own test procedures through the use of transfer standards, verification of the performance of converters used in

automatic test equipment, or testing of experimental converter designs during development.

Looking well ahead to the demands for speed and accuracy anticipated in future services we have developed and demonstrated, on a research basis, an analog-to-digital signal converter which is the fastest yet produced. This device, based on superconducting junction technology, can already deliver 6-bit resolution for 2×10^9 samples per second (2 GHz), the highest rate reported anywhere. This accomplishment is a significant step toward the 6-bit, 5-GHz capability planned for 1984 and it provides NBS with a key element of the metrological capability needed to support the emerging ultra-high-speed technology of gigabit electronics.

Optical fibers provide more efficient, interference-free communication channels now finding applications in many fields. A significant improvement in industry's ability to measure attenuation in optical fibers has been achieved, in part through NEL efforts in that area. A measurement intercomparison among manufacturers of optical fibers has been completed by NEL in cooperation with the Electronic Industries Association (EIA). Tested were methods currently pending before standards groups for determining attenuation, bandwidth, index profile, core diameter and numerical aperture of telecommunications-grade optical fiber, the most significant parameters for characterizing these fibers. The comparisons served to document the usefulness of some test methods and, to identify where more work is needed. The NBS cooperative effort with EIA to improve fiber optic measurement procedures is a continuing one.

The measurement of electromagnetic radiation in the environment is of concern to all levels of government, industry and the public. There are questions concerning the effects of electromagnetic radiation and problems with respect to electromagnetic interference (EMI). Existing measurement techniques and instrumentation are inadequate for determining the characteristics of the electromagnetic environment or the susceptibility of electronic components to that environment. Whereas the National Telecommunications and Information Administration provides policy and manages portions of the electromagnetic spectrum, NBS is expert in basic measurements across the spectrum. We are at work on improved techniques for measuring such electromagnetic radiation and for measuring the response of electronically controlled devices to such radiation. For example, NEL has just completed the theoretical and experimental development of a new antenna whose characteristics offer considerable potential for the next generation of instrumentation for measuring electric fields. The highly sensitive portable electric field probe described in my testimony two years ago was put into production by a private firm last year.

Our work on semiconductors provides the technical basis for voluntary or de facto standards for the buying and selling of semiconductor production equipment, materials, and devices. This effort responds to demands for new measurement science, demands generated by the markedly smaller (micrometer and submicrometer) dimensions and the vastly increased complexity of VLSI circuits. These demands include tighter control of dimensions, material purity, and other parameters, as well as new testing concepts. In some cases buyers specify parameters of the process by which a chip is made and therefore there must be agreement on how to measure the process performance. We have

developed a way to build into the chip a structure which can be tested electrically to give a measure of a particular process parameter.

For example, one test structure will detect faults in conductors in 1-, 2-, 4-, and 8-micrometer geometries. A production-compatible test structure for fast electrical measurement of mechanical alignment of device elements has been shown to be sensitive to misalignments as small as 0.1um. The NBS test structures have already been transferred to industry in magnetic-tape format for immediate use. These structures enable the buyer to specify critical features of a chip.

Discrete Parts Technology

This program includes two components. The first - our automated manufacturing effort - provides the standards and the metrological services for the automation of the discrete parts manufacturing industries. The second part includes research on improvements in the measurement services associated with such fundamental physical quantities as length and force.

The discrete parts manufacturing industries produce things one at a time, such as parts for aircraft, for autos, and machine tools. They produce 75 percent of all U.S. trade in manufactured goods while contributing $150 billion in value added to the GNP. Although this sector of the U.S. economy includes 35 percent of all U.S. firms, over 100,000 of these (or 87 percent of the total) have less than 50 employees. These industries are in a position to reap significant benefits from automation and it now appears they must automate to successfully compete, in both foreign and domestic markets, with Japan,

Germany, and other industrial countries. These competing countries have major national programs in automation.

The completely automated small-batch manufacturing system or flexible manufacturing system consists of such elements as metal cutting machines, computers, terminals, robots, conveyers, and measuring or inspection systems. For the most part, each of the separate components listed above are produced by independent manufacturers. Therefore, the small-batch manufacturer who wishes to automate must buy the various components from several manufacturers. The buyer is then faced with the problem of making the various components work together. Some of the most sophisticated technological companies can do this successfully. However, most of the small-batch manufacturers lack the required technical capability. This lack of ability to readily combine automation equipment from different manufacturers is a serious barrier to the adoption of automation by small-batch manufacturers. Each of the links requires an interface between disparate devices and hence an interface for communication protocol. Therefore, we must develop standard interfaces to go between these various components of the automated facility. This program will provide the technical basis required, primarily implemented through the voluntary standards community, to remove these interface barriers.

In its continuing efforts to support the private sector standards groups, NBS with the support of the Air Force and a consortium of companies developed the Interim Graphic Exchange Specification (IGES). This specification attacked a market barrier which had grown up in the field of computer-aided design (CAD). In order to protect proprietary interests, no two CAD systems could

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exchange data, hence, if a design were made on one system, no change in that design could be made unless the person needing the change either had exactly the same model system or was willing to convert the design data into a drawing, make the required change, and manually re-enter the drawing into his CAD system. By means of a public data bank structure developed by the IGES industry/NBS team, this barrier was technically broken in January 1980. In September 1981, the American National Standards Institute approved a national standard which adopts this work as part of its text. The neutral third party posture of NBS and its reputation for technical competence made this possible.

With the installation and test of an automated work station, NBS measurement scientists were able for the first time to attack measurement problems which were delaying the adoption of full automation. We have, for the first time, fully measured the inevitable errors built into a milling center and showed that these errors can be corrected by software in the machine controls so as to achieve accuracies beyond the ability of a skilled machinist. Hence, normal machines in a normal shop environment can manufacture parts that previously required hand work on special machines.

The automated manufacturing facility of the future will have the measurement function built into the process. This will replace the manual measurement of parts during or after production. This advance creates a new problem: how does the manufacturer maintain quality control of his measurements, i.e., how does he know he is making the parts to the correct dimensions or shape, during the manufacturing process if he does not use the traditional method of manual measurement? In the present manual or semi-automatic production environment there exist well recognized quality control systems which provide buyer and

seller assurance that the products have the correct dimensions. These systems are supported by NBS calibration programs. Our program will develop new physical standards and measurement services to enable the small-batch manufacturer to calibrate his automated facility relative to national standards.

Congress appropriated for fiscal year 1982 an additional $1.5 million to continue establishing our automated manufacturing research facility. We are also providing additional funding to support the facility and will continue to supplement equipment funding from our general working capital fund as available. This will allow us to complete the establishment of the facility as described in the fiscal year 1982 budget and to continue our research program to provide the discrete parts manufacturing industry with the metrology, data, and standards needed to reap the benefits of automation.

We expect the proposed fiscal year 1983 decrease in direct appropriations to be offset by an increase in the support provided by the private sector and by other government agencies. Support from the private sector will include research associates sponsored by industry and their trade associations.

We are also continuing our traditional role of keeper of the U.S. national standards and providing measurement services to tie to them. An important interchange of force standards between the United States and the United Kingdom was carried out in the high force range 0.5 to 4.4 meganewtons (100,000 to 1,000,000 lbs. force). The interchange was most successful, reconfirming the accuracy of the NBS deadweight machines and allowing the

National Physical Laboratory of the United Kingdom to tie their hydraulic machines closer to the international standards.

NBS, under the auspices of the International Bureau of Weights and Measures, once again demonstrated the validity of the U.S. standards by showing the U.S. meter to be right on the mean for the international meter to 1 part in 10^8.

At the very bottom of the size range, NBS scientists showed that by use of laser levitation of small particles and light scattering from those particles we can determine particle size as a function of time with a resolution of 3 nanometers. The measurement of such particles is vital to understanding smoke and soot formation and many biological phenomena.

Chemical Process Technology

This program provides the chemical process and associated industries with fundamental measurement science and critical data, not available from other sources. it enables these industries to calibrate their measurements relative to national standards and to obtain data essential for process design and control. In both cases, the total societal benefits are large, but no single company can capture enough of the benefits to justify its doing this research.

In the measurement portion of this program we are emphasizing the development of new techniques to measure the flow of solid/fluid mixtures and critical measurement methods for flow stream composition, temperature, viscosity, and density. Many industrial measurements must be made in harsh environments. We are providing suitable methods. In addition, we are developing calibration services for fluid measurements needed for industrial process control and for

equity in trade for liquids and gases. Also we are developing improved predictive methods for heat and mass transfer for use by the chemical and petrochemical industries.

Thermophysical properties data are needed for key substances (reactants and products in process streams). Predictive models are required to extend the measured data from a small set of measured substances to predictions of these data for many other substances over wider ranges of conditions. We respond to these needs by providing accurate data and theoretically-based predictive techniques for characterizing critical materials and fluids for the chemical and petrochemical industries.

We have developed a new computer program that predicts the density, viscosity, heat capacity, and thermal conductivity of hydrocarbon mixtures over a wide range of pressures, temperatures, and compositions. This computer package is being distributed widely by the Gas Processors Association to industrial firms.

We have developed and put into service a new experimental facility to measure the pressure-volume-temperature (PVT) relations in fluids from 300-900° K with pressures to 35 MPa (300 atm). This new device extends PVT measurements into ranges of great interest to the process industries. The facility features a highly automated system of temperature measurement and control; first measurements are being made on propane; hydrogen sulfide will be next.

Building Research

NBS provides the technical basis for the voluntary standards used in building codes and specifications. Improved standards and codes are intended to reduce costs in building construction by: (1) providing greater building reliability and durability; (2) reducing losses from high winds and earthquakes; and (3) reducing operating and maintenance costs. Program activities include work in structural, geotechnical, materials, thermal, acoustical, illumination, mechanical, and electrical engineering.

NBS plays an important third party role in investigating failures in buildings, usually structural collapses. Although this is a very limited activity, it is very important both in helping us to know the needs for improving standards and codes and in assisting government officials having jurisdiction. We have completed our investigation done at the request of the Department of Labor, into the March 27 collapse of the Harbour Cay Condominium in Cocoa Beach, Florida. The five-story, flat-plate reinforced concrete building collapsed while under construction, killing 11 workers and injuring 23 others. After conducting onsite technical investigations, laboratory tests, and a variety of analytical studies, NBS researchers concluded that "the most probable cause of the failure was insufficient punching shear capacity in the fifth floor slab to resist the applied construction loads."

At the request of the Mayor of Kansas City and members of Congress from Missouri, we are conducting an investigation to determine the most probable cause of the collapse at the Kansas City Hyatt Regency Hotel (over 100 persons dead). This study has drawn upon the resources of both the National

Engineering and National Measurement Laboratories. The report will be completed later this month.

Similar investigations by NBS of structural collapses as part of the construction safety research program have shown a need for improved test methods for determining the strength of structures. We are currently working on this problem. A uniform set of probability based-load criteria developed in conjunction with the American National Standards Institute will be used for the design of all types of structures resulting in simple, less costly design procedures and safer more economical structures.

We have recently made available a new measurement service for thermal insulation. Transfer specimens developed with a high-precision, guarded hot-plate capable of measuring thermal performance of thick insulation will provide substantial savings to insulation manufacturers through improved process control and give purchasers better information on insulation performance. We are distributing calibration transfer specimens for use in conjunction with the "representative thickness" provision of the Federal Trade Commission rules on "Labeling and Advertising of Home Insulation." The specimens are being provided at thicknesses of about 25 mm (1-inch), 75 mm (3-inch), and 150 mm (6-inch).

Other recent accomplishments in this program include: acceptance by the American Society for Testing and Materials of a standard for prediction of service life of building materials; of adoption as standards by the American Society for Heating, Refrigerating, and Air Conditioning Engineers test methods and calculation procedures for determining thermal efficiency of

furnaces, boilers, heat pumps and air conditioners as a function of seasonal weather variations; development of a method for measuring and rating steady-state room noise that provides the basis for the first ANSI standard on this subject; development of criteria for reduced size plumbing adopted by model codes; development of a soil classification method for improving construction excavation practices; and development of draft seismic provisions for Federal buildings for the President's Earthquake Hazard Reduction Program. The earthquake program will be discussed in greater detail when I appear before your subcommittee on Wednesday to discuss this program.

Fire Science and Engineering

Our research on fire has three elements: study of fundamental phenomena, development of techniques to predict fire behavior, and development of proposals for more effective standards, codes, and practices to facilitate transfer and use of the new information. We recently made significant progress in understanding of ignition, smoldering combustion, formation of soot particles in flames, turbulent behavior of fire plumes, and mechanisms of thermal degradation of solid fuels. Each of these advances are producing results which we plan to use in prediction tools and in standards or codes. For example, the turbulent behavior of fire plumes is part of our mathematical model of fire behavior in a room and ignition is important in many test methods used to evaluate material performance.

Techniques to predict fire behavior are essential for materials manufacturers, designers, and code officials. We must know the effects on fire growth and spread of changes in materials, configuration, ventilation, and connection to other parts of the building. Mathematical models have been developed now to

the point where we can predict to acceptable accuracy some of the key events in a room fire. Greatest success has been had with predicting temperature rise vs time for a single room. Soon we plan to be able to extend the models to a set of rooms and to handle the rate of generation of smoke particles and gases vs time.

We continue to seek improvements in test methods. We presently have before the National Fire Protection Association's Fire Test Committee a test for the ease of ignition (by lighted cigarettes) of upholstered furniture. We are completing work on a test method to measure the toxicity of combustion products. Our procedure for measuring by oxygen consumption the rate of heat release, a major advance in assessing fire hazard, has been extended from small items to full scale (burning complete items of furniture and even entire rooms). We are also making progress on tests for smoldering combustion.

Our success in improving the Nation's building codes is highlighted by the incorporation into the NFPA Life Safety Code for health care facilities our method for evaluating trade-offs in design for a given level of safety The Life Safety code is used by the Department of Health and Human Services for evaluating and upgrading facilities using funds from Medicare and Medicaid. Our method is now being extended to other institutional facilities such as intermediate board-and-care facilities and prisons. We expect the method to be in the 1984 version of the Life Safety Code. Cost savings from our work are considerable in retrofit of old facilities and in new construction because our method permits a choice from a set of low cost options instead of a single, rigid prescription.

I am scheduled to appear tomorrow before this subcommittee at which time I will review the background and current status of the pass-through funding in support of this program. As I have noted, the fiscal year 1983 budget for NBS includes a transfer of funding estimates for fire research from the FEMA budget to NBS.

Mathematical Sciences

The Bureau's new and evolving technical programs continually increase the need for the most advanced mathematical, statistical, and computational techniques. Work in applied Mathematics provides such support services for all NBS programs. The staff provides mathematical competence to insure the integrity and reliability of NBS experiments and measurement systems, the accuracy of NBS data, and the efficient and accurate theoretical modeling and computation required in both our applied and basic research studies. Our major thrusts include: mathematical analysis, scientific computing, operations research, and statistical engineering. Our NBS mathematicians, statisticians and computer scientists have played a key role in much of the measurement work I have already described.

The mathematical analysis work emphasizes the theoretical modeling of physical systems and the development of required mathematical techniques, numerical mathematics and software for studying complex problems in science and engineering. Much of the work is done in collaborative teams of NBS mathematicians and other members of the NBS staff. For example, the mathematical modeling of temperature buildup in a room fire has been carried out in collaboration with the Center for Fire Research. Advanced computerized methods for calculating, storing, refining, and displaying phase diagrams for

metal alloys have been developed in collaboration with the National Measurement Laboratory at NBS and the American Society of Metals.

The operations research work includes the analysis and application of large scale discrete models. These models provide a quantitative basis for design optimization and operations planning for engineering structures and systems, and for the cost-benefit analysis of regulatory, economic, and administrative processes. Recent accomplishments include the development of an improved method for testing very-large-scale integrated circuits, in support of our VLSI program, and the development of state-of-the-art techniques to optimize the design tradeoffs in the NFPA life safety code that I mentioned.

Our statistical engineering work provides statistical techniques for planning, modeling, and interpreting experiments, analyzing experimental data, developing measurement systems, and providing statistical support for our Measurement Assurance Programs. Sampling methods and means for estimating errors in the collection of data for compliance testing are included in this work. NBS measurement results, such as calibration reports and standard reference materials, are accompanied by explanations of their precision and accuracy, based on experiments designed for careful statistical analysis of all possible sources of error. As an example of our contributions to error analysis on the international scene, our statistical group in Boulder, working with scientists in the time and frequency group, is pioneering the use of a new time-series technique to improve the precision and stability of the Universal Time Scale, which is kept at the level of 10^{-14} seconds based on a battery of atomic clocks. This procedure will be presented this summer to the

international body overseeing the International Time Scale for eventual adoption.

Computing

Scientific computing activity includes the development of numerical analysis and computational methods for all NBS scientific and engineering problems. A significant ingredient in this work is the selection, adaptation and development of state-of-the-art computer software for use in scientific and engineering computations and the provision of software, systems design and test methods to support the development of automated laboratory systems and instrumentation for use throughout NBS. We recently published internally a detailed technical compendium of mathematical software which provides the staff at NBS with selections from among the best mathematical and scientific software available anywhere in the world. We plan to update this collection continually to keep abreast of this fast moving field. For large-scale computation problems, NBS is carefully monitoring the modern developments available in software, hardware, special computing languages, and in adapting some of our computer codes so that that may take advantage of vector-type processing.

Our central scientific computing activities are located in the Center for Applied Mathematics, with significant benefits to all of NBS from this association.

Computers play a pervasive role throughout science and engineering. There is a great diversity in requirements for computers, ranging from the smallest to the largest. In recognition of the basic dependence of our programs, NBS

management took two essential actions several years ago: it authorized the design, development and operation of a state-of-the-art internal communications network, and it created the Scientific Computing Division.

Today computers and telecommunications are inextricably linked; to most efficiently utilize limited scientific staff, it is vital to match computing capability to specific tasks. There must be small computers for data acquisition and experimental control, there must be more powerful processors to analyze large volumes of data and carry out scientific computations, and there must be access to the largest computers available for frontier problems. Further, graphical services and a variety of software is needed to enhance the productivity and effectiveness of scientists and engineers.

In our vision of adequate computing service, the internal network is the crucial element that links the varied computers, terminals, and specialized devices. The weakest element in our environment has been the central computing facility. We are proceeding with our plans to upgrade that facility.

This focus on electronic aspects shouldn't obscure the underlying importance of an adequate support staff. Without an adequate and capable staff, the best hardware cannot be effectively utilized. Significant progress has been made in recruiting an excellent staff of specialists in scientific computing. In assembling this staff, there has been a recognition of the ultimate importance of scientific software.

We are acquiring upgraded capability for our central computing processor system at NBS. An upgrade for our current central processors will be installed this month as an interim solution. Equipment should be in full service in late March. A special group is heading a major coordinated effort to acquire a replacement for our central computing system for NBS. The RFP for this was published in final form in December 1981. As Dr. Ambler noted, NBS will run its scientific computing on the UNIVAC 1100/82 transition computer until early fiscal year 1984 when the replacement computer is fully operational. The 1100/82 will continue to be used for NBS administrative computing and for other DoC computer requirements. The schedule may slip, however, because Congressman Brooks has requested a brief, 60-day study by the General Accounting Office of the planned requisition of scientific computers by NBS and NOAA to see if economies may be effected by some form of consolidation.

This completes my review of our programs in engineering and applied science. I believe the Laboratory is correctly positioned to deal with today's challenges. The staff is strong, morale is surprisingly high, and we are getting on with our technical work. I shall be pleased to answer any questions the Subcommittee may have.

Mr. WALGREN. Thank you very much. I appreciate those statements. We will have to pursue the leads that are contained in them perhaps more through written interaction with you than verbal but that is the function of the hearing and it will give us a good starting point to continue our discussions.

Dr. Ambler, you mentioned in your statement that you are moving away from the automation and the materials, or you are reducing the automation and the materials function that you had been pursuing in the previous year, and yet that certainly was one of the real bright spots in recent developments at the Bureau of Standards, that they were active in those areas.

How can we assess the impact of having to reduce our effort in those areas?

Dr. AMBLER. Well, first of all, Mr. Chairman, I still feel that these programs are important and I still feel that with the present budget request we can pursue them.

More generally, let me say it is very difficult for me, as Director of the National Bureau of Standards, in reviewing all the programs that we do, and with all the pressures that are on us to provide services, to set priorities. I think one of the things that is always important is that if we have programs that are not yet fully staffed, those programs must have a lower priority generally than an established program doing excellent work. The program priorities are a close call in any event, and the additional disruptions that would be caused by having to fire all the employees on one program to pursue the original plan on the new program, would be, on the whole, counterproductive.

Now in the automation program we will, with the funds available in 1982, be able to equip the facility that we have talked to this committee about. We have a plan in 1983 for raising funds from the private sector and perhaps from other agencies. I think that we are hoping to be able to secure about $600,000 in that way. If we can do that and perhaps redirect a little of the effort in the same center to this program, I think that the level of funding, the total level of funding if I could include all sources, equipment as well as staff costs, will not fall very much short of what we are spending in 1982.

We plan to spend in 1982 for all aspects of this program, $3.5 million, and I expect to be able to spend in fiscal year 1983, $3.2 million.

Mr. WALGREN. Is that including moneys from other sources that you are going to try to develop?

Dr. AMBLER. Yes; that includes about $600,000 that I expect to raise from sources other than the STRS appropriation for operations and an additional $300,000 of donated equipment

Mr. WALGREN. What about overall in your Bureau? What has been the reduction in direct Government funding as a percentage of your budget compared to last year?

Dr. AMBLER. The 1983 request is $104.4 million. The NBS fiscal year 1982 budget, was $120.3 million. That, just looking on the face of it, looks like a big reduction,but I should point out that there is a reduction of $12.2 million as a result of the transfer of ICST to the General Services Administration. So that, really, I think the

better way to look at this is as a reduction from about $108 million to about $104 million.

Mr. WALGREN. What was it that was transferred to General Services?

Dr. AMBLER. It has not been transferred; it is being proposed to Congress; we need legislation for this. It is the Institute for Computer Sciences and Technology. This is the organization within the National Bureau of Standards that discharges our computer standard responsibilities under the Brooks Act, the Federal Property and Administrative Services Act of 1949.

Mr. WALGREN. But would they be fully funded in that other capacity?

Dr. AMBLER. They will be funded by the General Services Administration.

Mr. WALGREN. Is there any indication of how fully funded they would be?

Dr. AMBLER. Mr. Kammer, I think, has that figure, sir.

Mr. KAMMER. Sir, their fiscal year 1982 appropriation is $12.2 million. The proposal for fiscal year 1983 is $7.1 million. So there is a reduction of approximately $5 million.

Mr. WALGREN. I see. So just in general, we see $5 million lost there, and your indication is $4–5 million lost in your own shop. So that would be a $10 million loss out of $120 million.

Dr. AMBLER. I think it is more like a $4 million loss in our shop, so it would be $9 million if you add it in that way.

Mr. WALGREN. I see.

How do we balance the indications that the core function, particularly of pure measurement, as indicated by Mr. Gramm, may be suffering in our pursuit of some of the other technologies? Do you feel that there is a shortfall at this point in our ability to provide measurements to the States—measurement and training? What are we doing in that area, and why does there seem to be this kind of indication that people want more to be done?

Dr. AMBLER. Before I address directly Mr. Gramm's concern, you did indicate, and I believe Mr. Gramm did too, this concern for the fundamental measurements area.

I would like to point out that what we do there is far more than what we do only for the States. Measurement systems are used by everybody at every level of sophistication and not just in weights and measures, masses and volumes, but in all the various areas that Dr. Hoffman and Dr. Lyons described. So it is a broad responsibility of the National Bureau of Standards.

Provision of the fundamental basis of physical, and chemical measurements is a core responsibility of the Bureau, and should be the number one priority. Having said that, let me turn to the specific concerns raised by Mr. Gramm with regard to the Office of Weights and Measures.

I think he put his finger on the problem when he said that the introduction of electronics and microprocessors into scales and gas pumps has introduced a new technology that has come upon the community rather suddenly.

I am spending a great deal of time myself now talking to the various officials, trying to figure out how to approach this problem, and I think I have a plan. But before telling you about that plan,

let me mention that the National Bureau of Standards has supported the States' weights and measures officials for 75 years.

We have tried to answer all their questions, and respond to all their needs. And I think we are getting to the point where we have to sit down with the State and local officials and draw the lines of demarcation a little more clearly, because I do not know that we can continue to be all things to all people.

As I look at the support that we should give to the State and local governments, first of all, I think the number one priority—which we have always done and I think there is no complaint about it—is supporting their national conference. These are the regulators. They need to get together under some organization—and the Bureau of Standards is the right organization—to bring about some uniformity in the way they regulate in their own States, for obvious reasons.

Second, the people within the States, with whom we must be concerned as a first priority, are the heads of the various organizations—the chief of the laboratory, the State metrologist. We must make sure that his laboratory, which, as you may know, we helped equip over a period of time by providing them with new standards of mass and volume and so on, to make sure they had the basic capability to do the job—we must make sure that that person is fully capable of using these instruments, that the instruments are properly calibrated, that there is a measurement assurance, and that they are in good shape at the top of the chain. I think we do that.

How to approach this question of the complications introduced by electronics—I think the thing I have to do is to get involved in a program of national type approval. This is a program which the Scale Manufacturers are pressing us hard to do. Type approval essentially means you approve a given device—a scale or whatever it is—for use in commerce, and the way it has been going is that each State has tended to have a separate type approval, and that is onerous on everybody, including the manufacturers. So I think we have to have one program.

We have a plan that we are discussing with the subcommittee of the National Conference in regard to how we can involve them, how we can be involved, and how we can involve the manufacturers to have a type approval plan.

As to those manuals that Mr. Gramm mentioned, I think that when we do a type approval we ought to have a sheet of instructions—simple, straightforward instructions—that treats this device as a black box and tells the local inspector the procedures to be followed to make sure that that device is still within tolerance. I think if we did that, that would go a long way to meeting these concerns.

Those are not all the concerns of the States' weights and measures people. One of the concerns is with training. I have seen proposals to provide a general training program covering a wide variety of topics. Frankly, I am not convinced that this is a program that should be funded by the Federal Government. It seems to me that within the States there are plenty of local colleges and local communities which give courses in electronics and basic physics and that the education could be obtained in that way.

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Certainly, some of the proposals have called for large sums for paying travel and per diem of States' weights and measures inspectors to go and receive this training. I cannot see at all where it is the Federal Government's responsibility to do that, Mr. Chairman.

Those are my three priorities. My position on training is that the general type for the field inspector really should be picked up by the States, but if, in further conversation, it is felt that a limited amount of training would provide a familiarization of the States and local inspectors with electronics—just general principles of how they work, so that they will not be so nervous about it—we might consider how that might be done. I think we should be very limited in our approach, get our priorities right, and, as I said, I think we have to draw some firmer lines of demarcation than we have in the past.

Mr. WALGREN. I appreciate that answer. Before going off on that general question, I want to ask about the reductions in automation and materials. You indicate that we are going to be using a capability that prior investment has now given us, that could be continued with lower levels of funds, as you say. Is it possible to be more concrete than that?

I guess I am concerned that, after having made a certain investment, we now lose the benefit of that investment, and yet you are saying that there is a residual capability from having gone down the automation and the materials road that will be useful. Can you develop that at all for me?

Dr. AMBLER. I cannot give you any specific sources of funds at the present time to continue these programs, but I feel it is very important that we continue them. I want to continue them, and I think this option——

Mr. WALGREN. Is it contingent on outside funding—the kinds of things that we saw out there at the Bureau, the automated tooling and the like—is that contingent on outside funding?

Dr. AMBLER. To some extent, yes, it will be.

Dr. LYONS. Let me try that one, if I may, Mr. Walgren. In the automation program, we will, with the funds available to us, be able to set up the necessary machining centers. At the reduced level in 1982 we will not have certain redundancies that we had planned for in the original program. For example, we were going to have two horizontal boring machines and two vertical machines. And we will not be able to address all of the interfaces.

In the manufacturing facility of the future, for example, there will be computer-aided design facilities, where someone uses a computer to design the desired part. That will be coupled to a computer-aided planning system which will direct the resources to the machines and control the robots in delivering and fixturing parts. Then there will be a computer-aided manufacturing system which will actually control all the machines.

In the program that we envision, at the 1982 funding level we will be limited in our ability to couple the CAD to the CAP and the CAP to the CAM, but nonetheless, within the computer-aided manufacturing cells we can address the interfaces between, say, the robot and the machine tool. So we will not have as many things, and we will not have them as quickly, but we still will be doing the

essentials of the program, which are the measurement program and the interface standards.

It is our feeling that we can perform the needed service, perhaps not quite so elegantly, and it may take a little bit longer, but we can do the program.

Mr. WALGREN. All right. What about the environmental measurement effort that you have been involved in? Was that done with your own money to begin with?

Dr. AMBLER. I have to go back 3 or 4 years when we had $2 million in our STRS appropriation for this purpose. That was reduced to what you see here, $200,000, as a result of a decision by OMB that this should be funded by EPA. So this is really the same policy decision, that anything we do in this area will be done on funds that we get from EPA.

Mr. WALGREN. What kinds of things were you doing in that program?

Dr. HOFFMAN. Mr. Chairman, may I respond?

Mr. WALGREN. Certainly.

Dr. HOFFMAN. The amount of money that we had in direct funding in the environmental measurements program for fiscal year 1982 was $228,000. It was a vestige of a much larger program that was transferred to the Bureau 2 or 3 years ago in an earlier budget.

This work developed reference data and standards and measurement methods for pollutants and the things that contaminate the water and the atmosphere. A lot of the work was finished; the methods were developed and turned over to EPA. This was the basic nature of the program. What you see here is essentially the tail end and the tailing off of that program.

Mr. WALGREN. Can you make an assessment of the need there? Do you have any idea whether EPA will continue your effort? I realize that is not your Department.

Dr. HOFFMAN. If it is understood that I am making a surmise as I respond, I would say that they are pulling themselves together over there. They are now very interested in the Love Canal problem and getting that report out. I believe that from this and other experiences they will find new needs and new measurement technologies and science that they need; that is my impression. I believe I can say that our capability to develop the kind of things that they would run into, that they need, they could come to us for, and I believe we could carry out specific functions for them as they run across them in their studies.

Mr. WALGREN. I guess I am surprised that they do not use you on a regular basis inasmuch as the greatest problem environmentally is apparently how do you measure these things, or at least we do not have a history of measurement.

Dr. HOFFMAN. Over the past years, when this program was going full blast, they did use us on a regular basis, and we still have some other agency work from EPA. I would have to look up the figures, but it is not nearly as large as it was. But they do come to us on a moderately regular basis to get us to develop test methods, standard reference materials, gas standards, and the like.

Mr. WALGREN. Dr. Ambler, you mentioned the upgraded computer and that you will be procuring that at a lower annual cost.

Could I ask you to give, perhaps in writing, a summary of your evaluation of that cost factor and how you make the choice between buying the computer and leasing the computer, and what the costs over time would be, projected under each method?

Dr. AMBLER. Yes, I would be glad to supply that, sir.

[Material to be supplied follows:]

The NBS long term replacement computer will be handled through a fully competitive acquisition process. A Request For Proposal (RFP) was issued last December with proposals due in March 1982. The RFP was developed in a way that enables the competitive process to determine the mode of acquisition, that is venders may propose any combination of purchase and lease plans. The selection of the system will be based on the present value calculation included in the GSA cost evaluation model. The model is used to identify the system of lowest overall cost that can be acquired with the funds available. NBS will have a total of approximately $10 million available in 1982 and 1983 for use towards the acquisition of the computer system. The results of the evaluation of the costs proposed under the competitive process for both purchase and lease proposal can be released once the award is made.

Mr. WALGREN. I would like at this time to recognize the counsel to the minority, Mr. Rheem.

Mr. RHEEM. Thank you, Mr. Chairman.

I think this question would primarily be directed toward John Lyons. We have seen in the budget that the funds for the Center for Fire Research are about $500,000 less than the passthrough money that was to have come from FEMA. The question is: Is this reduction going to come primarily from the grant funding, or from the in-house research, or is it going to be split evenly? Do we have an idea on that?

Dr. LYONS. The funding will come from both parts of the program. I took a preliminary look at that yesterday. We are just now making the decision, for fiscal year 1982, in which year we expect to receive about $3.5 million from the passthrough from FEMA, so we have to make those decisions for this year.

They are not final yet, but it does appear that we will be reducing both some research on alarming and detectors—that will be a grants program—reducing some of our furniture work in-house, and probably in fiscal year 1983 we will be reducing our overhead by eliminating our liaison representative to FEMA. So it comes from all sources.

Mr. RHEEM. If FEMA does not fund the U.S. Fire Administration, which we anticipate, in their budget in fiscal year 1983, in your opinion, what effects will it have on the implementation of the Federal Fire Prevention and Control Act, and what effects will it have on your Center for Fire Research?

Dr. LYONS. If I may, I will only comment on the effect on the Bureau's programs, since I am not intimately familiar with how they propose to implement their budget proposal over in FEMA.

The effect of not having the U.S. Fire Administration on the Center for Fire Research is to reduce somewhat our contact with the Fire Service, in particular, in this country. The Fire Administration was a principal mode for us to talk with the Fire Service and to understand their needs.

However, there will be left in place, as I understand it, the Fire Academy, the training facility at Emmitsburg, Md., where senior officers come to receive training. It has been our continued desire

to help in the teaching at that Fire Academy, so I expect there will be some of that contact, plus the fact that our staff has many contacts with the Fire Service independent of the Fire Administration, so we will not lose that.

I would point out that the Bureau has done research on fire with the principal motivation of helping to provide a scientific basis for fire standards and fire codes in this country, and we have been doing that since 1901. The Fire Administration, in that perspective, came on the scene about 1975.

So obviously we knew how to deal with the problem of technology transfer for those other years, or I can assure you that we did, and the principal channel for our output from that program was, and still is, various committees on standards in the voluntary standards community, and in particular ASTM and NFPA—I think the committee knows those acronyms—and the model building code groups, of which there are four in this country; and State and local code officials.

We have very intricate network of contacts with all of those communities, and we did not go through the Fire Administration with those contacts, for the reason that the Fire Administration was not working on that particular technology transfer channel. So I think we will lose something in the contacts with the fire services community, but we will not lose in our channels to the codes and standards groups.

Mr. RHEEM. Over the last 5 years, can you give some kind of assessment on how effective the Federal fire program at the Fire Administration has been in terms of achieving the goal of a reduction in fire deaths? We have heard recently that there has been a reduction in fire deaths in the United States from about 7,800 per year to 7,600 per year, and there has been some speculation as to exactly what the cause of that drop has been. Do we have any data or statistics that would say whether it might be the work of your Fire Center, or the Fire Administration, or a combination of both?

Dr. LYONS. The data on the significance of the reduction in fire loss is anecdotal at best, in my opinion. I recently looked at that for another reason.

It is true that in the last year the figures reported are reduced somewhat more, I think, than you suggest. The reason for that is not apparent. Neither is it clear whether that is a trend. If you look over the fire loss figures, as I just did, from 1950 forward, the scatter is rather large, and so they will go up 1,000 or in some cases 2,000 in 1 year and come right back down again the next.

In addition to that, there has been a change in the basis on which one computes fire losses. In particular, fire fatalities have been controversial. In the days of the National Commission on Fire Prevention and Control, we were fond of saying there were 12,000, I think, per year in this country, and a careful look at the statistics showed that there was an enormous contribution from automobile fatalities which had failed to be corrected from about 20 years earlier, and we had all of a sudden to shift the base to 8,000 from 12,000.

I think the data are better than that now, largely due to the efforts of the Fire Administration and the NFPA in Boston, so that we do not have that kind of fluctuation.

There is also some clear evidence, I think, that in the case of the Federal standard on the flammability of children's sleepwear, it is now true, as I understand it, that if you go to a burn hospital the physicians will tell you they simply do not see children brought in with that kind of burn. So there are some things that have happened in the last 10 or 15 years that really have made a difference.

On the other hand, we still have the fire in the MGM Grand Hotel in Las Vegas, and the Las Vegas Hilton; we had a terrible fire up in New York, in the Stouffer Inn, and more recently this weekend, as you know, a holocaust in Japan, where we have been fond of saying they do this fire control business better than we do. So there is still a lot of loss and a lot of pain in fire.

Mr. RHEEM. So you do not think, in effect, that the data we have are accurate enough to determine whether there actually has been a reduction in the last year in fire deaths?

Dr. LYONS. No, I am not that confident on a 1-year basis. If you looked at trends over, say, 5 years, that would be useful. I think the trends are clearly down per million population in this country. They are still high relative to other countries, but they are down. I think the subcommittee knows about the advent of the smoke detector in the home, for example, which I am sure has made a difference.

Mr. RHEEM. The figures for arson are quite different than those figures for overall fire deaths, in that both property loss and death related to arson are up and up significantly.

The U.S. Fire Administration has played an important role in coordinating the work of various Federal agencies in arson prevention and control. Can you see where there might be a shift there? Do you think the Center for Fire Research might be able to do some of that work, or is that not the kind of thing you would like to do? Where will that focus go, in effect?

Dr. LYONS. The Fire Administration focused attention and concern—along with some Members of Congress, I should point out—on the arson problem, and a lot of local officials also kept hammering on this point.

The arson problem, I suppose, is a social problem that I am not competent to address—as to why it is on a rapid increase—but it certainly correlates with lots of other unpleasant things that also are on the increase.

The Bureau's role in that was to develop some information for arson investigators, and we did pull together, on the advice of the Fire Administration, a very effective manual for use by arson investigators, and we have done a bit of work on things like the sniffers that are used to detect accelerants, namely gasoline and related fluids.

So we had a technical role to perform, and we did so. As far as I know, that effort is complete, at least for now. The Fire Administration, on the other hand, has continued to press the arson issue, along with the Department of Justice and others.

Mr. RHEEM. Again, with regard to this coordinating role, do you see anybody stepping into that void if the Fire Administration is, in effect, closed down? I know that they coordinate that ad hoc group, the Federal Task Force on Arson Prevention and Control.

Do you see a niche for that somewhere else, or are we going to be in trouble as far as that coordination goes?

Dr. LYONS. I think there are private sector groups that will continue to try to serve that role—for example, the Fire Marshals of North America and the National Fire Protection Association in Boston. As I said, the Department of Justice has been interested in the legal aspects of this, and indeed in some cases have taken the lead. So I think there will be a continuing concern with it. There will not be that obvious focal point that the Fire Administration presented.

Mr. RHEEM. OK. Thank you.

Mr. WALGREN. Along the same line, it is my understanding that the Fire Administration conducted a technology-related program where they did things like, I gather, testing sprinklers and fire suppression apparatus, and now with them being apparently eliminated, do you envision the Center for Fire Research taking on any of those functions?

Dr. LYONS. The Federal Fire Prevention and Control Act of 1974 has two separate and distinct provisions, one covering research and development of the usual kind that the Bureau does. In fact, that was the section that established the Center for Fire Research at NBS and enumerated in considerable detail those things that we were to perform, and we are so doing.

Another section, section 12, laid out a technology development program of hardware-oriented work and I think specifically mentioned detectors, suppression systems, and the like—apparatus for firefighters. That was assigned to the Fire Administration.

So at the moment, Mr. Walgren, the NBS, as it stands, is not authorized to do hardware development. Furthermore, as I think you are aware, as we agonize over our priorities, we have always said that the Bureau ought not to do product development, an activity that is fundamentally the business of private firms.

What we try to do, and have indeed been doing in both detection and suppression, is to develop the underlying technology and to make sure that the fire standards and fire codes are current and up to date. We have been doing that, we are doing it, and we will continue to do it.

Mr. WALGREN. Would it be wrong to measure effectiveness of such equipment though?

Dr. LYONS. No; it would not, and we do that. We, for example, have been helping with the so-called residential sprinkler system and evaluating the performance.

Mr. WALGREN. Maybe we are picking over words, but you could develop generic technology, could you not, under your authorization?

Dr. LYONS. Sometimes it gets a little fuzzy. Certainly in the area of smoke detectors some years back, before the commercial explosion, we did exactly that. We defined what it was that a smoke detector needed to measure, what the pitfalls were, and how you could get into serious false alarm situations, and we published essentially generic information which enabled the manufacturers to upgrade their devices. We have been doing the same thing in sprinklers for a long time, trying to understand what is the optimum

way to disperse the water and how you aim it at the potential fire source.

Mr. WALGREN. But your testimony is that there is no basis for wishful thinking that the activities of the Fire Administration in technology development will be carried on at all by the Center for Fire Research?

Dr. LYONS. In the development of the hardware that is correct; we do not propose to do that.

Mr. WALGREN. If the Fire Administration is ended, that effort will end at the same time?

Dr. LYONS. That is my understanding, sir.

Mr. WALGREN. In the Center for Fire Research, I am informed that we had about 105 people and a budget of $8.5 million last year. What do we project for this coming year?

Dr. LYONS. The figures are down somewhat, Mr. Walgren. I do not have them; perhaps Mr. Kammer does.

Mr. WALGREN. I would like to think of it as an overall from all various sources, whereas, as I understand it, 105 people and an effort that could be measured by $8.5 million—what do we expect the Center for Fire Research will have in this proposed year in staff and in total resources available to it?

Dr. LYONS. Let me try a rough guess, and then perhaps Mr. Kammer will want to correct me. First of all, we do expect to have a half-million dollars less in direct funds passed through from FEMA this year than last, and that transposes roughly into five fewer people.

The problem is with the reimbursements from other Federal agencies. It is very hard to guess exactly where we will be, say, at the end of the year. Mr. Kammer tells me it will be about 95 positions at the moment and about $7 million, so it is going to be somewhat reduced.

Mr. WALGREN. What is the dollar loss again?

Dr. LYONS. We are showing $7 million as opposed to $8.5 million, but, as I say, it is not clear how much reimbursement we will get from a variety of sources. We have a variety of other Federal sponsors, and so, by the time the year is up, we may find that is up somewhat.

Mr. WALGREN. So we are reducing from $8.5 million to $7 million?

Mr. KAMMER. Yes, sir, that is an estimate, and we will not be sure until the end of the year because of the vagaries of other agency sources, but approximately, we are down 10 people and $1.5 million.

Mr. WALGREN. So that is about 20 percent or thereabouts in financial effort.

Dr. LYONS. Financially, and in terms of staff it is down about 10 percent.

Mr. WALGREN. What will not be done when we go through a year with 20 percent less funding that would have been done had we gone through a year with full funding?

Dr. LYONS. As far as the direct funding goes, I have indicated—let me try that again—we are proposing not to do some of our grants program, and that is primarily in the area of alarms and detectors. We believe we have come to a logical stopping point

there. Second, we are proposing to reduce some of our work, particularly at full scale, on fires in furniture. Third, we are reducing overhead by reducing our liaison assignment to FEMA. We had a full-time employee working on liaison with the Fire Administration.

Mr. WALGREN. What would be the reduction in the furniture fire area?

Dr. LYONS. We have been studying the burning rate of various selected items of furniture, trying to develop an improved method of test for that, for the standards communities. There is always a judgment question as to how many full-scale fires does one have to have before you verify the predictive model. We are simply going to reduce the number of those very expensive full-scale fire tests.

Mr. WALGREN. I see. By how many would you reduce it?

Dr. LYONS. They vary, depending on whether you are in a furnished room or whether you are just burning an isolated piece. A furnished room fire test probably costs, say, $15,000 a crack, and we are talking about saving perhaps $100,000. So if it were that kind of a test, that is five or six tests.

Mr. WALGREN. So the furniture fire area is being reduced by $100,000 out of the $1,500,000. What are the other reductions?

Dr. LYONS. I should be able to save $100,000 in this liaison representative; it is a senior man. The grants would be about half of the $500,000, so that is another, say, roughly $250,000, and I suppose for miscellaneous a saving of $50,000.

The other million is estimated other agency work that will not come to us, and I do not know what that is. We will not know until the year is over, and it may be not so bad.

Mr. WALGREN. I see. So the other agencies are not going to be asking you to do certain kinds of fire research.

Dr. LYONS. That is variable. We have received some reimbursements from the Fire Administration in the past. Obviously, we will not get that in fiscal year 1983, and we probably will not have that in fiscal year 1982 either. We had a very large contract with the Department of Health and Human Services, and that is winding down.

Mr. WALGREN. Mr. Rheem?

Mr. RHEEM. The research results from these various burns in your facilities out there—how do you distribute the results of that research? In other words, what is the channel for getting that out to the different people? Has that been through the Fire Administration, or has a significant portion of that been through the Fire Administration?

Dr. LYONS. Not really. Of course the Bureau publishes its work in Bureau reports, and on many occasions it also republishes, if you will, in trade journals or archival publications, the scientific literature. So there is always that mechanism.

Second, and very importantly, we transfer the information by personally discussing it with people in various standards bodies, code groups, and the like. We also occasionally hold workshops and conferences in which we present our findings verbally. There are a variety of techniques.

The Fire Administration has been helpful in arranging some of these things. We have gone to their annual conference, for exam-

ple, and our staff members have made presentations in a number of ways, and we used to help with the firemaster planning program by going around the country and addressing local officials.

Mr. RHEEM. If the Fire Administration is closed down, could you say that maybe 30 percent of your distribution work will go with it, or can you put that kind of figure on that?

Dr. LYONS. No, I would say more likely 10 percent.

Mr. RHEEM. OK, thank you. Thank you, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. Rheem.

There are only two other questions then. With respect to the pullback in materials work, Dr. Ambler, I understand that you were involved in a joint program with industry to develop what is called phase diagrams for steel. There is some concern in some quarters about the withdrawal from that by NBS, at least as far as your portion of the funding was concerned. Can you tell me how much you spent on that effort and whether or not you intend to discontinue that program?

Dr. HOFFMAN. May I respond to that, Mr. Chairman? I think what we are talking about is the metals processing work at the Bureau of Standards; a small amount of the dual phase steel work was in that. The question was raised—which I am adding to this question—why the reduction, and what are we going to do with it?

The program on metals processing had really a number of parts—alloy coatings, rapid solidification, and dual phase steels. It was in the predictive models and data part of the program, which was with the American Society of Metals, a consortium of users of metals and producers of metals, that we had this work on phase diagrams.

The brief answer, somewhat oversimplified, to the question about this reduction is that what we had originally planned a few years ago when we got together with the American Society of Metals and made our plan was that what we were going to do in 4 years we are now going to do in what amounts to 12 years; it is basically a stretchout.

I cannot at this moment tell you exactly what the amount of money that we had on dual phase steels was. Unfortunately, that is the work that, in the stretchout, we will have to delay to a quite a bit later time.

There is an emphasis in the rapid solidification portion of our program on the iron-aluminum-chromium alloy system, at the present time, which we do not want to drop. I am trying to establish the priority. The reason for that is, incidentally, that there is a concern about the supply of chromium, and aluminum can substitute for chromium in iron-aluminium-chromium alloys. We thought that was of considerable importance to pursue. I could submit later the actual dollar figures. I do not happen to have them with me.

Mr. WALGREN. We would appreciate that, if you could outline the change of that program in some detail. That would be helpful to the committee, I think.

Mr. HOFFMAN. I will be very happy to supply that.

[Material to be supplied follows:]

The joint American Society for Metals (ASM)/National Bureau of Standards (NBS) program is aimed at evaluation and computerization of phase diagrams (road maps) for the design of metal alloys to be processed by conventional methods and

control of conventional processes by the metals industries. The NBS technical input into this program will not be directly affected by the proposed budget reduction. On the other hand, predictive models resulting from the Metals Processing program related to the new processing methods of rapid solidification and coatings will be available for inclusion in the phase diagram computer data bank only to the extent of other government agency or industry support. The development of these predictive models is the specific part of the program which would be stretched out to 12 years.

Mr. WALGREN. Dr. Ambler, going back to the general question of weights and measures, it is my understanding that, as was said, there is some concern about the support for the National Conference of Weights and Measures, and the question is, what is the level of commitment to this Directorate for Weights and Measures within the bureau? Is that a reasonable question?

Dr. AMBLER. Yes; the level of funding has been increased this year by $120,000. That brings it up to about $930,000 for this year.

There is funding in a related program that is concerned with the international aspects of legal metrology. This is a thing that is important to the U.S. scale manufacturers in their export business.

Mr. WALGREN. Pardon me for stopping you at this point, but perhaps we could get some assessment of that in writing, where that directorate fits in your funding scheme, what you are doing with it in terms of change, and why.

[Material follows:]

Funding for the Office of Weights and Measures (OWM) is included in the NBS budget subactivity entitled Measurement Assurance Program. In terms of the NBS organizational structure, this Office has been a division of the National Measurement Laboratory (NML) since FY 1976. During FY 1982, The OWM has been transferred to a new organization in the NBS Office of the Director. However, funding for OWM will remain in the same budget subactivity. This reorganization will provide a more direct line from the NBS Director to the role of NBS in the weights and measures community.

Mr. WALGREN. I have to go to the floor now, so I am through with the thoughts that I had that I wanted to share with you immediately. We have one further witness, so we will suspend for about 10 or 15 minutes.

I want to thank you for coming. That would conclude our immediate need to have your time. We look forward to trying to develop some of these areas with you in writing. Thank you very much.

Dr. AMBLER. Thank you.

[Recess taken.]

Mr. WALGREN. I apologize for the delay. The last witness is Dr. Edward Heffron, the chairman of the National Conference on Weights and Measures, who comes to us through the good auspices of the Michigan Department of Agriculture.

Welcome, Mr. Heffron. We appreciate your being here. Please proceed as you would like. A written statement will, of course, be made a part of the record. Please proceed.

[The biographical sketch of Mr. Heffron follows:]

Biographical Sketch

EDWARD C. HEFFRON, D.V.M.
CHIEF, FOOD AND DAIRY DIVISION
MICHIGAN DEPARTMENT OF AGRICULTURE

A native of Michigan, Edward Heffron received his undergraduate degree and Doctorate in Veterinary Medicine from Michigan State University. Since then, he has attended Lansing Community College and Wayne State University.

Dr. Heffron became associated with the Michigan Department of Agriculture in 1962. Prior to becoming chief of the Food Inspection Division (later merged with the Dairy Division to become the Food and Dairy Division) in 1976, he served as assistant chief for six years. The Food and Dairy Division is charged with the enforcement of food and dairy laws as well as those of economics, including weights and measures.

He is presently affiliated with the following professional organizations:

Great Lakes Institute of Food Technologists
Northwest Weights and Measures Association - vice president
Michigan Association of Weights and Measures Officials - president
American Veterinary Medical Association
Michigan Veterinary Medical Association - president elect
Western Michigan Veterinary Medical Association - past president
Association of Food and Drug Officials - laws and regulations committee chairman, and board director
Central States Association of Food and Drug Officials - past president
National Conference on Weights and Measures - conference chairman, past vice chairman, and past chairman of the liaison committee
Institute for Weights and Measures - trustee

He has also served on two local school boards as both a member and president as well as serving as chairman of the Finance and Building Committee at St. Michael's Parish in Grand Ledge.

At the present time, Dr. Heffron resides in Eagle, Michigan, with his wife. The Heffrons have two sons and one daughter attending college and a second daughter in high school.

STATEMENT OF EDWARD C. HEFFRON, CHAIRMAN, NATIONAL CONFERENCE OF WEIGHTS AND MEASURES, AND, CHIEF, FOOD AND DAIRY DIVISION, MICHIGAN DEPARTMENT OF AGRICULTURE, LANSING, MICH.

Mr. HEFFRON. Thank you, Mr. Chairman. We appreciate this opportunity to identify the position of the National Conference on Weights and Measures relative to resources of the National Bureau of Standards.

I will keep my remarks short in an effort to make them clear, because there are certain points that need to be very clear.

In article 1 of section 8 of the U.S. Constitution the States agreed to certain obligations and duties of the Federal Government, such as taxes and duties, excises, common defense, and general welfare. They also agreed that these should be uniform.

They went on further to identify that the Federal Government should fix the standards of weights and measures. They continued on to identify the powers that are not delegated to the United States by the Constitution nor prohibited by it to the States as being reserved to the States respectively or to the people. This language indicates that the States delegated the power of fixing those standards of weights and measures while at the same time reserving to themselves the responsibility of regulation and enforcement.

Following through, the National Bureau of Standards Enabling Act attempts to fulfill this Constitutional mandate by authorizing the Secretary of Commerce, through the National Bureau of Standards, to provide for certain standards, means, and methods of making measurements within these standards, including comparison of standards and cooperation with other governmental agencies and private organizations, and to act as an advisor to Government agencies on scientific and technical problems.

In addition, other functions included the study and improvement of instruments and methods of measurement, and also the compilation and publication of such data. It further specifies the use of NBS scientific and technical personnel for training and teaching purposes.

We do not find it surprising at all that NBS sponsors the National Conference of Weights and Measures, through their Office of Weights and Measures, in an effort to promote uniformity and sound metrological principles among the States.

As you are aware, active membership in this conference is limited to State and local weights and measures officials, while at the same time it allows for advisory members from concerned agencies of the Federal Government and for associate memberships providing industry input.

Though I am appearing here on behalf of the National Conference of Weights and Measures, I am also an administrator for a weights and measures program in the Michigan Department of Agriculture.

Our program has common characteristics with those of the 775 governmental weights and measures jurisdictions in the United States. However, in Michigan, we have one State jurisdiction with three subjurisdictions under a broad law umbrella with single standards.

The share of Michigan's budget for weights and measures is extremely small. Currently, it is about $1.2 million. Ironically, and perhaps realistically, the weights and measures budget in Michigan has increased in the last 2 years, in contrast to the general economic trends in Michigan over those same 2 years.

We have also increased the number of positions, and part of that has been in response to problems that could be associated with the—we refer to it as—depression in Michigan. Certainly, a good deal of it is in response to the greater technology in the weighing and measuring field.

The non-Federal governmental units, such as the State programs, are the result of a need for accurate weights and measures in commerce, but these units need the leadership, coordination, and expertise available from NBS.

These groups are not attempting to avoid vested responsibilities, but are finding continuation increasingly difficult and often impossible because of the failure of NBS to fulfill its relatively small but essential portion of the team effort.

The Conference has identified several needs which require funding and administrative support.

First, sponsorship of the National Conference of Weights and Measures. The Office of Weights and Measures of NBS has not been able to staff themselves sufficiently to provide the technical and administrative coordination and resources required for the timely provision of model laws and up-to-date technical handbooks.

The needs of the National Conference on Weights and Measures have outpaced the present capabilities of the Office of Weights and Measures, especially as it relates to new device and package technology and expansion.

Two outstanding examples related to economically important commodities include the changing methods and technology for the retail sale of petroleum fuel and the multiple manipulative methods of measuring grain moisture.

We feel the sponsorship of the National Conference on Weights and Measures is integral to the attainment of all other objectives. As an example, as new technology has affected the retail sale of petroleum fuel in the last 3 years, statewide in Michigan, we have had a 300-percent increase in consumer complaints relative to retail gasoline devices. In general, they relate to technological problems, although the complainer often does not identify it as such.

Number two—I say number two, but really they should not be in a numbered sequence—is for the National Bureau of Standards to maintain the Office of Weights and Measures. No other single Government agency has the scientific and technical resources and credibility, coupled with the ability to communicate with others in the area of weighing and measuring science and technology.

There are, and should be expected to be, increased requests for the Office of Weights and Measures to operate as a clearinghouse for weights and measures. As new technologies enter the marketplace, the primary resource for technical expertise and leadership for the State and local jurisdictions is the Office of Weights and Measures.

Among the new technologies are various types of electronic scales with remote sensor devices, which are presently experiencing problems with radio wave interferences. These can be manipulated for the benefit of the owner or operator of the scale.

Also, a practical method of measuring the accuracy of crude oil measuring devices is needed in order to assure that governments receive a fair tax and landowners receive an accurate, honest royalty. This issue has hardly been addressed at all. What's more, the technology is not yet up to addressing it.

Third, is the assurance of standards. NBS is the obvious, nonbiased institution to establish and maintain authenticity of standards through programs to make universal State standards, audits, and certifications of State metrologists and laboratories.

The current funding should be maintained to continue the Office of Weights and Measures' involvement in the assurance of standards. Increased funding is needed to audit and certify State laboratories and metrologists, and this is needed beyond the present emphasis on mass measurement to areas such as volume and pressure. And, there are other areas of certification that have not yet been addressed.

With regard to training, member jurisdictions fail to have adequately trained staffs at all levels. At present, there is no formal, comprehensive curriculum within any institution in the United States for an advanced legal metrologist, or, for that matter, a legal metrologist at any level.

The only training expertise resources—and they are extremely limited—are within the Office of Weights and Measures and within a few States. Evaluation of State programs demonstrates the need for uniform training at all levels, and only feeble attempts are being made to attain this.

With approximately 3,000 weights and measures officials in the United States, most have only on-the-job training, without direct professional oversight and advisement, often perpetuating already established procedures which are inadequate. A few States have professional engineers for administrators or resource persons, but none have the capability to adequately train all individuals.

It is recommended that funding be available specifically for the Office of Weights and Measures in its leadership role to initiate a scientifically and technologically sound training foundation accessible to all weights and measures jurisdictions.

Formal and semiformal training curriculums should be subjected to accreditation by NBS, if they grant degrees or are prerequisites to performing certain weights and measures regulatory activities.

The last area in need of more support, in our opinion, is "national type approval," referred to earlier in testimony by Dr. Ambler. State and local regulators of weights and measures do not have the technical or physical capabilities to examine and verify weighing and measuring device types or prototypes as being free from designs that could permit the perpetuation of a fraud or performance inaccuracy as well as other specifications and performance requirements.

In addition, separate verification by multiple jurisdictions would result in nonuniformity, be time consuming, unacceptable for

export, as well as unnecessarily costly for manufacturers and government agencies.

Funding is needed for administration by OWM of a national type approval program which could be, for the most part, self-sustaining, but allowing verification of devices, for both national and international trade.

A national type approval program could provide the administration mechanism for a national program by NBS—these would be the only costs by the Federal Government—while serving the best interests of both manufacturers and Government.

The key to recognition by all States—and I should say acceptance—and foreign countries is oversight and certification by NBS through the Office of Weights and Measures.

Mr. Chairman, those of us who have been working at relationships to share responsibilities for funding and goal attainment with a number of government agencies at one time realize that the relationship is not always well coordinated, and unfortunately, often cooperative in name only, greatly diminishing goal attainment.

My personal observation, which I believe is consistent with the observations of other NCWM members, has been that the Office of Weights and Measures and the weights and measures jurisdictions have an excellent relationship. It is professional, goal-committed, free of jealousies, and lacking of duplication of effort. I am thankful for the high degree of commitment and cooperation of the Office of Weights and Measures.

There is an item that bothers me as an individual, as an outsider. I work with two different types of budgets, one is for the total division that I administer, which is only about $6.23 million currently. I also, for 6 years, have been the administrator of a small town church parish. Among my chores is running the budget and finance committee.

I do not know how someone in an oversight position can be aware of funds unless they are identified clearly in a budget. This is something that bothers me. Perhaps it is possible, but I found, particularly with the church budget, which is about $300,000 a year, that we were much more efficient and effective when we started formally identifying the funds, so that we could anticipate and identify how they were to be spent.

Mr. Chairman, with the States and local jurisdictions conducting the bulk of weights and measures enforcement, with a relatively minimal but vital investment by the Federal Government, there exists an extremely valuable potential, impacting positively upon every citizen and business in the Nation. The National Conference on Weights and Measures is asking for recognition of the need for funding this minimal Federal investment.

I would be pleased to answer any questions that may come up.

[The prepared statement of Dr. Heffron follows:]

NATIONAL CONFERENCE ON WEIGHTS AND MEASURES

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Statement of

Dr. Edward C. Heffron, Chairman

National Conference on Weights and Measures

before the

Subcommittee on Science, Technology, and Research

U. S. House Committee on Science and Technology

February 9, 1982

Mr. Chairman,

We appreciate this opportunity to identify the position of the National Conference on Weights and Measures (NCWM) relative to needed resources of the National Bureau of Standards (NBS).

In Article 1, Section 8 of the United States Constitution, the states agreed "The Congress shall have power to lay and collect taxes, duties, imports and excises to pay the debts and provide for the common defense and general welfare of the United States, but all duties, imports and excises shall be uniform throughout the United States."

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"To coin money, regulate the value thereof, and of foreign coin, and fix the standard of weights and measures."

This article continues, "the powers not delegated to the United States by the Constitution nor prohibited by it to the states, are reserved to the states respectively, or to the people." This language indicates the states delegated the power of "fixing" the standards of weights and measures while reserving to themselves the responsibility of regulation and enforcement.

The National Bureau of Standards Enabling Act (15USC 271) attempts to fullfill this constitution mandate by authorizing the Secretary of Commerce, through NBS, to provide for construction of certain standards, to provide for means and methods for making measurements with those standards (including comparisons of standards and cooperation with other governmental agencies and private organizations), and act as an advisor to government agencies in scientific and technical problems. In addition, other authorized functions include the study and improvement of instruments and methods of measurement; advancement of engineering, mathematics and physical sciences for gathering data; and the compilation and publication of such data. It furthermore specifies the use of NBS scientific and technical personnel for training and teaching purposes.

It is not surprising NBS sponsors the NCWM (through its Office of Weights and Measures) in order to promote uniformity and sound metrological principles among the states. Active membership in the NCWM is limited to state and local weights and measures officials with advisory members from concerned agencies of the federal government.

I am appearing here on behalf of the NCWM, being an administrator for a weights and measures program in the Michigan Department of Agriculture. Our program has common characteristics with those of the 775 governmental weights and measures jurisdictions in the United States. These non-federal governmental programs are the result of a determination to cause accurate weights and measures in commerce, but need the leadership, coordination, and expertise available within NBS. These jurisdictions are not attempting to avoid vested responsibilities but are finding continuation increasingly difficult and often impossible because of the failure of NBS to fullfill its relatively small but essential portion of the team effort! The conference has identified the following needs which require funding and administering priorities.

Sponsorship of the NCWM

The Office of Weights and Measures (OWM) of NBS has not been able to staff sufficiently to allow technical and administrative coordination and resource for timely responses to the need for model laws and current technical handbooks. The needs of the NCWM has out paced the present capabilities of the OWM especially as relates to new device and package technology and expansion. Two outstanding examples include the changing methods and technology for the retail sale of petroleum fuel and the multiple manipulative methods of measuring grain moisture -- two of the most economically important commodities traded in the United States. The sponsorship of the NCWM is integral to attainment of all other objectives.

Maintain Office of Weights and Measures

No other single government agency has scientific and technical resourses and credibility, coupled with objectivity and

comprehensive communications with those in the area of weighing and measuring science and technology, as does NBS. There is and should be expected to be increasing requests for OWM to operate as a clearing house for weights and measures. As new technologies enter the marketplace, the primary resource for technical expertise and leadership for the state and local jurisdictions is OWM. Among the new technologies are various types of electronical scales with remote sensor devices which are presently experiencing problems with radio wave interferences. Also, a practical method of measuring the accuracy of crude oil measuring devices is needed in order to assure governments receive a fair tax and owners receive an accurate, honest royalty.

Assurance of Standards

NBS is obvious as an objective, non-biased institution to establish and maintain authenticity of standards through programs to cause calibration of state standards, audits, and certifications of state metrologists and laboratories. Current funding needs to be maintained to continue OWM's involvement in assurance of standards, and increased funding is needed to cause auditing and certification of state laboratories and metrologists beyond the present emphasis of mass measurement into areas such as volume and pressure.

Training

Member jurisdictions fail to have adequately trained staffs, at all levels. Presently there is no formal, comprehensive curriculum within any institution in the United States for an advanced legal metrologist or a legal metrologist at any level. The only training expertise resource, and it is extremely limited, is within OWM and within a few states. Evaluation of state programs demonstrate the need for uniform training at all levels and only feeble attempts are being

made to attain this. With approximately 3,000 weights and measures officials in the United States, most have only on-the-job training, without professional oversight and advisement, often perpetuating already established inadequate procedures. A few states have professional engineers for administrators or resource persons but none have the capability to adequately train all individuals. It is recommended funding be available specifically for OWM to cause initiation of a scientifically and technologically sound training foundation accessible to all weights and measures jurisdictions. Formal and semi-formal training curriculums should be subjected to the accreditation by NBS if it leads to a degree or is used to meet a prerequisite to perform certain weights and measures regulatory activities.

National Type Approval

Regulating weights and measures jurisdictions do not have the technical nor physical capabilities to examine and verify weighing and measuring device types or prototypes as being as free as possible from designs that could permit the perpetuation of fraud or performance inaccuracy as well as other specification and performance requirements. In addition, separate verifications by multiple jurisdictions would result in non-uniformity, be time consuming as well as unnecessarily costly for manufacturers and the governmental agencies, and unacceptable for export. Funding is needed for administration by OWM of a national type approval program which could be for the most part self sustaining, but allowing verification of devices both for national and international trade. A national type approval program could provide for the administration mechanism of a national program by NBS (the only costs by the federal government), while serving the best

interest of both manufacturers and government. The key to recognition by all states and foreign countries is the concept of oversight and certification by NBS through the OWM.

Mr. Chairman, those of us (and I am sure this includes most persons in this room) have been in a working relationship sharing responsibilities, funding, and goal attainment with any number of governmental agencies at one time. Complicating matters in the least, this relationship is not always well coordinated and unfortunately often cooperative in name only, greatly diminishing goal attainment.

My personal observation, which is consistent with that of other NCWM members, has been the Office of Weights and Measures and the weights and measures jurisdictions have an excellent relationship -- professional, goal committed, free of jealousies, and lacking duplication of effort. I am thankful for the high degree of commitment and cooperation by the Office of Weights and Measures!

Mr. Chairman, with the states and local jurisdictions conducting the bulk of weights and measures enforcement (with a relatively minimal but vital investment by the federal government), there exists an extremely valuable potential -- impacting positively upon every citizen and business in the nation! The National Conference on Weights and Measures is asking for recognition of the need for funding this minimal federal investment.

Mr. WALGREN. Thank you very much, Dr. Heffron. We certainly appreciate that perspective.

I would hope that we might be able to identify that budget for the Office of Weights and Measures a little bit more specifically when the department responds to our written inquiries.

What is the actual relationship between the Office and the National Conference? Do they transfer any moneys? Do you carry out on any contractual basis any functions for them, or are they simply the place that you go to try to get the support that you need in this area?

Mr. HEFFRON. The Office of Weights and Measures has these obvious relationships with the States. One is that they sponsor the National Conference on Weights and Measures by furnishing an executive secretary to coordinate the Conference. They also provide advice and resources necessary to compile background information, to compile the findings and put together handbooks that result from activities of committees of the National Conference, such as the Specifications and Tolerance Committee.

Michigan is like many of the States. We adopt handbook 44, in its entirety, for our specifications and tolerances in the State. In fact, tomorrow I will be back testifying on behalf of the updating in our legislature of handbook 44, which will be, like in most of the other States, the specifications and tolerances, because they adopt that.

The Office of Weights and Measures, in addition, conducts a laboratory auditing program. They audit our laboratory, and all the other laboratories that are certified, and I believe not all of them pass the audit—a good measure of stringent criteria.

They also furnish advice in the way of accumulating information that we may not have the access to. They can direct us to where we can get it, or they can furnish this information as a medium. We find this extremely helpful.

We have a specialist in our weights and measures section, out of our 32 people, who is a mechanical engineer.

We still need to call upon the Office of Weights and Measures for a variety of things that come up that are unusual and oftentimes to confirm what direction we should go in, in the way of technical support.

Mr. WALGREN. Has the National Conference been able to make an assessment of how much more support should be given to the Office of Weights and Measures by the Bureau in terms of dollars and manpower?

Mr. HEFFRON. We have avoided dollar marks, because we do not understand all the other priorities. We do not understand the amount of resource to begin with, and we think there needs to be administration responsibilities on handling those funds. So we have not attempted to identify precisely how much is needed. We can identify the needs without dollars on them, but we have not attempted to put dollars with them.

Mr. WALGREN. You have covered a broad variety of needs in your testimony. Have there been submissions to the Bureau by the National Conference listing these needs and setting them out in any greater detail, that might be useful for the Committee to know about and to work with the Bureau on?

Mr. HEFFRON. I believe the 5-year plan, as it is often referred to, has identified needs, and the outline as I have it here would vary a little bit, because it is a little more generalized than those needs. There is an attempt to identify persons and some dollars, I believe.

Mr. WALGREN. You may have been here earlier when Dr. Ambler testified and indicated he did not know how far they could go in the actual training of people. He sort of felt there were some initiatives he could take which would be responsive to some of your points, but for training programs, per se, is that going to leave us with the need unmet if we do not get into that area?

Mr. HEFFRON. As I see that area, there are unfortunately many jurisdictions which do not even realize that their staff is not trained to handle response to the newer types of technologies and weighing and measuring crises; they are not even aware of that. So in a sense it needs a leadership role. It would be difficult, I think, for a State or even two or three States to be able, in a practical sense, to put together a comprehensive training program.

The kind of resource they need would be a tenth of a person here, two-tenths of a person there, and it simply does not work out to where you could justify it on a small basis. That is one of the problems in training on weights and measures; it is such a unique field of a small dimension that the expertise is not practical in the units that we are speaking of, in a single State or two or three States. That is one of the problems we have.

We have that problem in Michigan, and we are very aware of training needs. I think we are one of the first States that have for a few years now required, for most of our staff, that they have a college degree. That is not necessarily in weights and measures but in our division.

Mr. WALGREN. I see. I certainly appreciate your testimony. There apparently is a feeling that, in pursuit of some of the other more technical, scientific efforts, the Bureau may not be doing what it should in its basic area of measurement and promulgation of measurements. The Committee will certainly try to work with them in that area, and perhaps we can incline them in the right direction; we hope so.

Mr. HEFFRON. Thank you.

Mr. WALGREN. Thank you very much for coming; we appreciate it.

Mr. HEFFRON. Thank you, Mr. Chairman.

Mr. WALGREN. We will recess until 1:30 p.m. tomorrow afternoon.

[Whereupon, at 4:10 p.m., the subcommittee was recessed, to reconvene the following day at 1:30 p.m.]

1983 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

WEDNESDAY, FEBRUARY 10, 1982

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY,
Washington, D.C.

The subcommittee met, pursuant to notice, at 1:35 p.m., in room 2318, Rayburn House Office Building, Hon. George E. Brown, Jr. (acting chairman of the subcommittee) presiding.

Present: Representatives Brown, Shamansky, Heckler, Weber, Gregg, Skeen.

Mr. BROWN. The subcommittee will come to order.

The chairman of the subcommittee is unavoidably absent in his district and has asked me to chair the session this afternoon, which I'm delighted to do because it involves a number of programs that I've had a longstanding interest in.

Yesterday the subcommittee received testimony on the Bureau of Standards' overall budget proposal for fiscal 1983. We also discussed two areas which are of special interest to the subcommittee and which are facing special problems this year: The Bureau's support for the fire mitigation program and for the National Conference of Weights and Measures.

Today we will cover two important subjects: We will continue our review of several problem areas facing NBS this year, and we will take testimony about the budget proposals for two separate agencies responsible for important work in the information and innovation fields for which authorization is required.

The proposal to transfer the Bureau's Computer Institute to the General Services Administration raises many significant questions. The proposal for this transfer appears to have been made somewhat hastily and without full consideration of the longer term implications for Federal information policy as it affects us both on the national scale and internationally.

I am personally concerned that GSA's lack of the required high-technology orientation and lack of career paths for scientific and technical staff may significantly reduce the usefulness of the Institute.

In view of the plan to leave ICST physically in its present location at NBS, there appears to be much merit in also leaving it organizationally within NBS, where it enjoys the same high respect of the technical and industrial community which all of the Bureau's activities have so justly earned.

In any event, this committee intends to work closely with the other committees of the Congress in arriving at a determination of the soundness of the proposed transfer, if and when legislative proposals are in fact submitted to the Congress. We will continue to exercise the authorization and oversight authority for this important program in accordance with the rules of the House.

The National Technical Information Service performs a key function in the dissimenation of information about the extensive science and engineering studies done by and for the Federal Government.

In October 1981, the administration closed the Smithsonian Science Information Exchange and theoretically transferred its functions, but not its resources, to NTIS. The coupling of this event with the fiscal year 1983 proposal to reduce the budget for NTIS while making it more self-sustaining deserves our careful review.

Two of NBS's technology programs have up to now been conducted in very close cooperation with the Federal Emergency Management Agency. These are the fire research program and the earthquake hazards reduction program.

Under OMB's concept of establishing lead agencies for multiagency programs, we have in the past funded NBS's contribution in these two areas by means of pass-through funding in the FEMA authorization acts. We are now faced with what amounts to a breakdown of this lead agency approach, and we will have an opportunity to discuss the future of both programs with representatives of both agencies in the course of this hearing.

Finally, we are looking forward with a good deal of interest to hearing from the head of the Office of Productivity, Technology, and Innovation about the reorientation of the work of this important office.

We have worked closely with that office in the previous administration, and we will want to discuss with the recently appointed director both the older programs of OPTI, including especially the implementation of the Stevenson-Wydler Act, and the interesting new initiatives proposed by OPTI in the fiscal year 1983 budget.

We will examine with special interest the proposal to provide a small staff within OPTI to continue the work of the U.S. Metric Board, a subject on which the committee began oversight hearings earlier this week.

I always get a kick out of reading these opening statements. I think they're intended to convey a signal to the witnesses. [Laughter.]

Mrs. Heckler could not be present, and asked that we insert a brief opening statement on her behalf.

[Material to be supplied follows:]

HONORABLE MARGARET M. HECKLER
NBS AUTHORIZATION HEARINGS
9 - 10 FEBRUARY 1982

THANK YOU, MR. CHAIRMAN. IT IS A PLEASURE TO BE HERE THIS AFTERNOON FOR THE BUREAU'S SECOND AUTHORIZATION HEARING.

THE NATIONAL BUREAU OF STANDARDS IS NOTED FOR SCIENTIFIC AND ENGINEERING EXCELLENCE NOT ONLY IN THIS COUNTRY BUT AROUND THE WORLD. WE ARE VERY PROUD OF THIS AGENCY, AND WE HOPE WE CAN WORK WITH YOU TO MAKE A GREATER IMPACT ON THE VITAL WORK YOU ARE DOING.

IT IS IMPORTANT THAT YOU CONTINUE TO CONTRIBUTE TO THE SCIENTIFIC AND TECHNOLOGICAL CAPABILITIES OF THE NATION. THE FUNCTIONS OF THE BUREAU ARE ESPECIALLY SIGNIFICANT IN VIEW OF THE NATIONAL CONCERN FOR TECHNOLOGICAL INNOVATION AND THE NEED FOR NEW PRODUCTS IN ENERGY, INFORMATION PROCESSING, COMMUNICATIONS, AND MANY OTHER AREAS.

THIS MORNING WE WOULD LIKE TO REVIEW THE OVERALL NBS BUDGET FOR FISCAL YEAR 1981, WHICH REPRESENTS A TOTAL OF $104,362,000. WE HOPE TO BECOME MORE FAMILIAR WITH THE FUNCTIONS OF THE BUREAU IN ORDER THAT WE MAY PROVIDE THE SUPPORT THAT IS NECESSARY TO EFFECTIVELY MEET THE BUREAU'S NEEDS.

WE ARE INTERESTED IN THE FUTURE OF THE FIRE AND EARTHQUAKE MITIGATION PROGRAMS CONDUCTED JOINTLY BY NBS AND THE FEDERAL

EMERGENCY MANAGEMENT AGENCY AND THE BALANCE BETWEEN BASIC RESEARCH AND TECHNOLOGY SUPPORT TO INDUSTRY AND LOCAL GOVERNMENT IN NBS'S PROGRAMS. THE FUTURE OF THE WORK ON DEVELOPING COMPUTER STANDARDS NOW BEING DONE BY THE NBS'S INSTITUTE FOR COMPUTER SCIENCE AND TECHNOLOGY (ICST) IS ALSO OF SOME CONCERN.

I LOOK FORWARD TO HEARING TODAY'S TESTIMONY ON THE ADMINISTRATION'S BUDGET PROPOSALS FOR THE NATIONAL BUREAU OF STANDARDS.

THANK YOU.

Mr. BROWN. Now, we were scheduled to hear first from the Honorable Glenn English, Congressman from Oklahoma and member of the Government Operations Committee, with regard to some of the issues involved in the Institute for Computer Sciences and Technology and its transfer.

Mr. English is detained at a hearing in another committee and I understand will not be able to be here, but without objection we will include in the record at this point any written statement that Congressman English wishes to insert.

[A biographical sketch and the prepared statement of Mr. English follows:]

BIOGRAPHICAL SKETCH

Congressman Glenn English

Oklahoma Sixth District

Glenn English was born in Cordell, Oklahoma on November 30, 1940. After graduating from Cordell High School, Mr. English attended Southwestern State College in Weatherford, Oklahoma, receiving a double degree in Business and Economics in 1964.

Prior to his election to the 94th Congress in 1974, Representative English served on the staff of the California State Assembly, the U.S. House of Representatives, and the Oklahoma Democratic Party. Before beginning his first campaign for election, he returned to Cordell to work as a petroleum landman, helping to promote the development of oil and gas properties in western Oklahoma.

Congressman English serves on the Agriculture Committee, the Select Committee on Narcotics Abuse and Control, where he chairs the Task Force on Drug Abuse in the Military, and the Government Operations Committee. He is Chairman of the Sub-Committee on Government Information and Individual Rights which has jurisdiction over the Federal Communications Commission, the Justice Department, the United State Postal Service as well as the Veterans Administration and legislation dealing with the Freedom of Information.

He was selected as the "Outstanding Man in Agriculture" in 1980 by Progressive Farmer Magazine in recognition of his work in behalf of farmers and rural Americans.

Congressman English is the son of Mr. and Mrs. Glenn English, Sr. of Cordell. Glenn and his wife, Jan, have a son, John Lee, and a daughter, Tyler Janene.

ENGLISH, OKLA., CHAIRMAN
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NINETY-SEVENTH CONGRESS

Congress of the United States

House of Representatives

GOVERNMENT INFORMATION AND INDIVIDUAL RIGHTS
SUBCOMMITTEE
OF THE
COMMITTEE ON GOVERNMENT OPERATIONS
RAYBURN HOUSE OFFICE BUILDING, ROOM B-349-B-C
WASHINGTON, D.C. 20515

February 10, 1982

Honorable Doug Walgren
Chairman, Subcommittee on Science, Research,
and Technology
Committee on Science and Technology
2319 Rayburn House Office Building

Dear ~~Mr. Chairman~~ Doug:

Thank you for your invitation to testify regarding the work of the Institute for Computer Sciences and Technology (ICST) of the National Bureau of Standards. I regret that a conflict with the business of the Government Information and Individual Rights Subcommittee makes it impossible for me to appear before you in person. I would like to describe for you, however, the vital work of ICST in international telecommunications policy, emphasize the importance of the continued work of the Institute to any realistic United States program in international telecommunications and information policy, and ask that these comments be included as part of your hearing record.

International Communications and Information Policy

For the past two and one half years, the Government Information and Individual Rights Subcommittee has actively pursued its oversight responsibilities of Executive Branch activity in international telecommunications and information policy. Out of that work have come two formal reports ("International Information Flow: Forging a New Framework", H. Rept. 96-1535, and "International Shortwave Broadcasting and Direct Broadcast Satellites", H. Rept. 97-398) and a bill, currently awaiting floor action, aimed at rationalizing the international communications and information policy making structures of the Executive Branch (H.R. 1957). A key finding of those reports and a critical motivation for the legislation is the disturbing state of United States Government policy formulation and implementation: the United States Government simply has not done the job.

Although we spend millions in total on the development and implementation of international communications and information policy, we get little return on the investment. Responsibilities are fragmented, authorities conflicting and fragile, resources inadequate, and control

of implementation often not in the most expert hands. The sum of all this is that the United States has yet to undertake the planning, setting of priorities and real concentration of effort that is necessary to effectively represent American interests.

The work of the Institute for Computer Sciences and Technology is a heartening exception to the general problem. We should not permit its work to be undone or its contributions lost.

Work of the ICST

Over the last three years ICST has worked to develop a set of computer-communications networking standards to meet the needs of the United States Government. To ensure that its work will ultimately prove useful and makes sense in the larger community of computer and telecommunications vendors and users, ICST participated in the International Standards Organization (ISO) network standardization activities. As a consequence of that participation, ICST developed a productive relationship with the European Computer Manufacturers Association (ECMA) and learned a great deal about high level protocol standardization within the Federal Republic of Germany. All of these activities are of importance to the United States, particularly with regard to the growing problems of international barriers to the flow of information.

The primary objective of ICST efforts in network standardization has been to develop protocol specifications which will be implemented in off-the-shelf products which facilitate computer to computer and terminal to computer networking. To take full advantage of networking potential, protocols must operate efficiently over a variety of communications facilities, including public data networks, local area networks, satellite networks, and office system networks. In order to arrive at the point where you can simply buy a product off the shelf and plug it in, standards must be developed and accepted by the international community so that computer manufacturers do not have to implement different protocols and network architectures for different countries, or worse, for organizations within countries. All of the protocol work of ICST is based on the international technical consensus growing out of its work in ISO. ICST, working as a technical expert within ISO, has been a primary contributor to ISO developments.

ICST also has worked closely with the European Computer Manufacturers Association in that organization's network standardization activities. ECMA has been a primary contributor to the network standardization activities within ISO. The ECMA members develop ECMA standards which are provided as proposals to ISO. The ECMA members representing different countries then vote as a bloc within ISO. ECMA is influenced extensively by the European Postal, Telegraph and Telephone Authorities (PTT's) because they must use the PTT's services. There is strong coordination within each country between ECMA participants (computer manufacturers) and local PTT's and government.

Over the past 18 months ICST has been given an open invitation to participate as an observer in ECMA meetings. Through this participation differences between ECMA and ICST proposals have been negotiated. There has been a much faster rate of convergence within ISO as a result of ECMA/ICST agreements. This cooperation, of course, minimized potential conflicts and difficulties for the United States government and businesses.

Perhaps the most important result of the ICST contribution to ISO and ECMA is not the standards themselves, but that the United States participated in their development and can live with them. Barriers to the flow of information and to trade in services based on inconsistent technical communications standards are a growing problem for U.S. enterprises; in its area of expertise and responsibility ICST has taken critical steps to avoid more of those problems.

A side effect of the ISO and ECMA activities of ICST has been the accumulation of information about other nations' policies, plans, and programs in the data communications area. The Institute's knowledge and expertise in this area are vital to the work of a number of agencies, notably the Department of State, the National Telecommunications and Information Administration, and the United States Trade Representative. The Institute's sources of information can probably not be readily duplicated elsewhere in government. Equally important, ICST has the experience and expertise to interpret the information it receives and to pass its knowledge on to other agencies in a form they can apply to their own work. Recently, for example, the Institute began to provide invaluable technical assistance to the Trade Representative on a variety of telecommunications and information trade questions.

The relationship between ICST and the Subcommittee on Government Information and Individual Rights has benefitted the subcommittee's work enormously. I believe we have also been able to assist the Institute in passing its knowledge on to those who most need it. As outlined above, the Institute's work and its knowledge are invaluable; we cannot, as a nation, afford to lose them.

In this time of budget cutting and fiscal restraint, we must set priorities. Given the importance of information technologies to the culture and economy of this country, and particularly to its trade potential, we must preserve those functions of government that support and enhance the development and application of those technologies. As you move through the authorization process, you should make the Institute for Computer Sciences and Technology a priority item.

Thank you again for your invitation. I hope that my brief comments here have been of some help to you and the subcommittee.

Cordially,

Glenn English
Chairman

Mr. BROWN. We will take as our first witness Mr. James Burrows, who is Director of the Institute for Computer Sciences and Technology in the National Bureau of Standards.

Mr. Burrows, I think in deference to the continuity of your presentation, it would be better if we went over and voted on that rollcall that was just signaled, and then we'll come back and hear you in toto.

Mr. BURROWS. Yes, sir.

Mr. BROWN. The subcommittee will be in recess for a few minutes.

[Recess taken.]

Mr. BROWN. The subcommittee will resume its sitting.

We have received a draft of the text of Congressman English's statement, which we will insert in the record, as I indicated.

I think it might be helpful to read the last paragraph of his statement, which in general is highly laudatory of the ICST. He says:

> In this time of budget cutting and fiscal restraint, we must set priorities. Given the importance of information technologies to the culture and economy of this country, and particularly to its trade potential, we must preserve those functions of government that support and enhance the development and application of those technologies. As you move through the authorization process, you should make the Institute for Computer Sciences and Technology a priority item.

We appreciate that statement.

Now, Mr. Burrows, we're pleased to have you with us to discuss the activities of the Institute. You've had a couple of years to recover from your last appearance here, so you should be in great shape this afternoon. [Laughter.]

You may proceed with your statement. The full text, of course, will be included in the record at the appropriate place.

Mr. BURROWS. Thank you, sir.

[The biographical sketch of Mr. Burrows follows:]

JAMES H. BURROWS

James H. Burrows is Director of the Institute for Computer Sciences and Technology (ICST), one of the three major technical operating units of the National Bureau of Standards. ICST manages the governmentwide Federal computer standards program, provides technical assistance to Federal agencies in the use of computer technology, and conducts related computer science research. These activities are aimed at improving economy and effectiveness in the procurement and use of computers by the Federal government.

Mr. Burrows was the Associate Director of Computer Resources for the U.S. Air Force headquarters from July 1972 until May 1979 when he took over the post at NBS. Prior to 1972 he directed the development of large information systems and data management projects for the MITRE Corporation and the MIT Lincoln Laboratory.

A member of many technical panels and committees, Mr. Burrows served on the President's Reorganization Project for Federal Data Processing. This group of computer professionals from both the public and private sectors conducted an in-depth study of the ways in which the Federal government acquires, manages, and uses data processing technology.

Mr. Burrows received his M.S. degree in 1952 from the University of Chicago and his B.S. degree in 1949 from the Massachusetts Institute of Technology.

said in your statement that you would use principally existing studies. To what extent, however, do you visualize your office going out into the universities and the private sector and either through contracts or grants, getting studies, additional studies or summaries of studies in a particular field done on your behalf? You do have contract authority, do you not?

Mr. MILBERGS. Our fiscal year 1983 budget does not provide for any contract funds with respect to contracting to universities or any other outside parties.

Dr. HOLMFELD. The committee here was fairly intimately involved 4 or 5 years ago when the National Bureau of Standards did, I think they were called the ETIP studies, the experimental incentives study. Now you have stressed in your testimony the emphasis which you and the administration wish to place on incentives, so I would ask you, to what extent have you had a chance to look at those particular studies which were focused on the incentives business? Have you found those of use to you in your current work?

Mr. MILBERGS. I am kind of delighted you asked the question. Some years ago when I was at SRI International, I happened to have the privilege of working under contract for that particular program.

This program is being phased out of existence during fiscal year 1982. No funds have been provided, as I understand it, in the NBS budget to continue ETIP activities in fiscal year 1983.

For the past 5 or 6 years, as I understand it, some $14 million has been spent in doing research in the area of setting up experiments, collaborating with other agencies, and also evaluating the results of those experiments. The intent of that program was to try to conduct those experiments in order to create kind of an empirical data base on various policy changes and then build enough of those experiments to see if you could generalize for a broad policy change.

The staff now, as I understand it is completing its work, tying up its business, the final contracts, is completing a report summarizing the results of all the experiments that have been done, and we are planning to be recipients of those results. Our staff will look into the conclusions that have come out of all that research. Believe me, if there are some good ideas, good incentives, new approaches to stimulate technology that have come out of that, we will be in a position to develop the recommendations and take it to my boss, the Assistant Secretary for Productivity, Technology and Innovation, to the Under Secretary when that position is established, to the Cabinet Councils, and to the Productivity Advisory Committee.

Dr. HOLMFELD. Yes; that leads into my next question. You mentioned that you will be reporting to the Assistant Secretary for Productivity, Technology, and Innovation.

Mr. MILBERGS. Right.

Dr. HOLMFELD. There was such an office, as you surely know, in the last administration. However, as you yourself know, they had the Patent Office, the NBS and others reporting to them. Could you tell the committee who in addition to your office will now, under the new system, report to this new Assistant Secretary?

Mr. MILBERGS. Well, we have proposed a reorganization. We have consulted with the relevant committees in the House and the Senate about it, and in addition to the Office of Productivity, Technology, and Innovation, my office, there will be an Office of Strategic Resources—the main focus of that will be on materials and minerals policy—and the Office of Business Analysis, whose basic role will be to determine what the sectoral implications of macropolicy changes are. In other words, we will be trying to look at the performance of the economy at an industrial level in terms of how various industry sections are affected by broad changes in policy. Therefore, those will be the three major units that would be reporting to this Assistant Secretary.

Dr. HOLMFELD. To our best knowledge there has not yet been a nomination by the President for this Assistant Secretaryship. Do you have anything you could——

Mr. MILBERGS. The White House is responsible for announcing nominations for positions like this.

Dr. HOLMFELD. Well, what I want to ask you is, are we talking about this spring? Is this moving forward?

Mr. MILBERGS. We are very anxious. The reorganization has essentially been approved, as I understand it, by the House and the Senate. We are proceeding through that process and I know that the Deputy Secretary and the various others involved in this want to move as quickly as possible to get it up and running.

Maybe I should correct for the record but I think this is also partially linked to the Under Secretary for Economic Affairs proposal, and that is still under final negotiations and consideration.

Dr. HOLMFELD. Yes; I think the Senate acted on that last December.

Mr. MILBERGS. The House is where it is going on, yes.

Dr. HOLMFELD. A general question about your views with respect to the implementation of the Stevenson-Wydler Act. I think you gave a useful discussion of how you will approach that. On the other hand, if we understand correctly, the administration is not asking for any funds to carry out that act specifically, including some of the things that would clearly need funds. What is your view of the various activities that the act calls for which clearly would require you to swing into action and spent funds?

Mr. MILBERGS. Within our proposal for fiscal year 1983 of roughly $1.9 million, we plan to be pursuing virtually each of the sections of the act. Now we are in complete concurrence with the committee with respect to the overall intent and the objectives of the act.

As I indicated, in section 5 we are going to be concentrating on using existing studies that have been done and concentrating on action recommendations. We think it is time to deal with the problem of economic recovery.

Second, on section 6, as you know we have indicated in my testimony that the approach there will be in technical assistance, and clarification of barriers to the formation of cooperative R. & D. arrangement. We are indeed planning a public workshop in this particular area.

We plan to carry out the functions that are prescribed in section 11 and indeed we have formed an interagency committee on tech-

nology transfer. We are working very closely with the NTIS with respect to the collection and dissemination of the assessments from the ORTA's and on a format and contents for biannual reports.

We are going to be looking into the question of the formation of the NITB, the National Industrial Technology Board. We are looking at the functions and the charter of what such a board is. When we have completed our analysis of that, that will be forwarded to the Secretary for his decision.

In the area of personnel exchanges, which is section 13, in our future meetings with the NSF, Federal Lab Consortium, OSTP, we will be talking to them about this area of personnel exchanges. I noted that Dr. Ambler yesterday in his testimony mentioned that he was expanding his industrial research associates programs from 100 to 200 over the next 5 years, and we think that is a very positive direction which is reflective of the intent of section 13.

Dr. HOLMFELD. Well, I am sure you know that the act provides authority for the expenditure of up to $50 million for these so-called Centers for Industrial Technology. Can you tell us whether you have some thinking about how you would move forward with those centers?

Mr. MILBERGS. As I indicated, we have a different point of view in terms of how to go about implementing cooperative R. & D. Maybe I could just make a statement: What seems more important to me in cooperative R. & D. is the question of leadership, very strong personalities, and flexible institutional arrangements, particularly, let's say, between universities and industry. I do not think the problem is money provided by the Federal Government in terms of cooperative R. & D.

Second, we have the President's Economic Recovery Tax Act which provides powerful incentives. If you look at the legislation—I am sure you are very familiar with it—there are some very strong incentives in terms of increasing R. & D. investment.

Third, I think in reviewing the proposal for cooperative R. & D. and what was termed generic technology, I was a little confused in my own mind about exactly what was meant, if you will, by generic technology. However, as I understand it the definition was, the kind of research which might have a large social return but where such benefits are nonappropriable, if you will, by the various players or potential investors in that kind of technology. That was my understanding of it.

My feeling is that those kinds of conditions can exist, particularly in disaggregated industries, for example, ones that are very, very fragmented. However, I think we should look first to the institutional relationships in terms of how these industries can begin to work with each other, and try to find out what the institutional barriers are to their cooperation.

In fact, we have found in just people calling in to us—What are you going to do with the cooperative technology program?—there were perceptions, for example, of antitrust barriers in terms of being able to put things together. These perceptions are not necessarily connected to reality in terms of how the antitrust laws are actually applied.

Therefore, we think the first thing that ought to be looked at is private initiative. Let's look at institutional flexibility in these

areas, and let's look to various barriers that might exist in terms of Federal policy.

Finally, I would like to point out that the evidence in terms of cooperative R. & D. is very, very positive in this area. I have a list which I would be happy to provide for the record, of numerous cooperative R. & D. activities going on without the involvement of the Federal Government but rather activities that have been initiated by the private sector. We see this going on in many places around the country today.

Mr. BROWN. We would appreciate having that list, Mr. Milbergs. We are aware of some efforts in this direction, and we commend them. I think they are extremely useful. We would like to know about more of them.

Do you have any further questions?

Dr. HOLMFELD. No, sir.

Mr. BROWN. You have made a very good statement, Mr. Milbergs, reflecting the administration's philosophy with regard to that. Speaking only for myself, I do not particularly agree with it but I think it is a consistent and a coherent program. We trust that it will be subjected to the same sort of analysis that you are apparently going to make with regard to some of the previous efforts that have been suggested by this committee and by previous administrations.

I am inclined to feel personally that the administration's economic recovery program has to prove itself as yet, and that perhaps some sort of a mixed programs would be the solution to the problem, which I think we both would identify in approximately the same terms. I am afraid that there is going to be some skepticism about the effect of that program unless it begins to show results some time in the reasonably near future, however. Since you are treating the previous programs with that skepticism, however, it is only fair I guess that it should be reciprocated.

We have some additional questions but because of the lateness of the hour, I am going to ask if you would respond to any of the more important ones in writing, if you would.

Mr. MILBERGS. I would be delighted, Mr. Chairman.

Mr. BROWN. Thank you very much for being here.

[Material follows:]

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Economic Affairs
Washington, D.C. 20230

March 31, 1982

Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research, and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

During my testimony before your Subcommittee on February 10, 1982 I offered to provide for the record a list of cooperative research activities initiated by the private sector without government funding.

The Federal government does not require reporting of cooperative research activities to it. Accordingly, we do not have a list of all private sector cooperative research activities. Thus, you should consider the attached list which was compiled from a variety of sources as only illustrative.

The list is divided into two basic categories: Industry Cooperative Research and University-Industry Cooperative Research. The category Industry Cooperative Research has been divided ito three subcategories: Trade Assocation Type Research Programs, Joint Research Ventures and Limited Research Partnerships. The University-Industry Cooperative Research category has been divided into two categories: profit and nonprofit. Since organizational format, time-frame, specific technology or industry focus, and funding sources vary among the samples on the list the categories are not discrete, and specific examples may overlap into other categories.

The whole area of cooperative research in the U.S. is in a state of transition. There appears to be growing activity in the private sector especially in limited research partnerships and in university-industry relationships. Also, the Microelectronics and Computer Technology Enterprises cooperative venture recently proposed by Control Data Corporation represents a major attempt by American industry to remain competitive in the world market through collective action in a key area of industrial technology.

This Administration perceives its main job in this area to be the maintenance of a positive environment in which these relationships and projects can spring up and flourish without government intervention. In addition, we intend in the near future to publish in the Federal Register for comment our new guidelines under which the Department of Commerce can provide technical assistance to private sector groups wishing to establish cooperative research ventures.

I trust that the attached list will be useful to you.

Sincerely,

Egils Milbergs

Egils Milbergs
Director
Office of Productivity,
Technology and Innovation

Enclosure

Additional Information for the Record of the Testimony of Egils Milbergs, Director of the Office of Productivity, Technology and Innovation, U.S. Department of Commerce Before the Subcommittee on Science, Research, and Technology of the House Subcommittee on Science and Technology, February 10, 1982

ILLUSTRATIVE LIST OF COOPERATIVE RESEARCH PROJECTS

I. Industry Cooperative Research

A. Trade Association Type Research Programs

The following examples include primarily trade association type organizations, both those that do their own research in-house and those which contract it out. This list is from a 1974 study performed by Dr. Francis W. Wolek, then of the University City Sc ence center of Philadelphia, Pa. on the role of consortia in the national R&D effort. These organizations are funded primarily by their membership contributions, with government funds accounting for about 2.9% on an average percentage basis.

Greater Than $10 Million/Year

Electric Power Research Institute
American Gas Association*
Bituminous Coal Research
Institute of Gas Technology*

Greater Than $1 Million/Year

Cotton, Incorporated
American Institute of Steel & Iron
American Petroleum Institute
Institute of paper Chemistry
Portland Cement Assocation
International Lead & Zinc Research Organization
National Council of Paper Industry for Air & Steam Improvement
National Canners Assocation
American Association of Railroads
Target
Motor Vehicle Manufacturers Association
Coordinating Research Council
International Copper Research Association
American Newspaper Publishers Association

Greater Than $100,000/Year

American Plywood Association
National Center for Resource Recovery
Beet Sugar Development Fund
Nutrition Foundation
Textile Research Institute
Metal Properties Council
Graphic Arts Technical Foundation

Malting Barley Improvement Association
Institute of Textile Technology
International Fabricare Institute
International Association of Plumbing & Mechanical Officials
Cosmetics, Fragrances & Toiletries Association
National Restaurant Assocation
Soap and Detergent Assocation
National Asphalt Pavement Assocation
Sulfur Institute
American Cocoa Research Institute
Glass Container Industry Research
National Concrete Masonry Association
Wine Institute
National Dairy Council
Tile Council of America
Gravure Research Institute
Manufacturing Chemists Assocation
Gas Processors Assocation
Brick Institute of America
American Institute of Baking
Western Highway Institute
Paint Research Institute
National Lime Association
Cast Iron Pipe Research Association
National Crushed Stone Assocation
American Concrete Pipe Assn.
National Claypipe Institute

*Most of the programs of these organizations were merged into the Gas Research Institute formed in 1976.

Recent highly visible examples of this type of cooperation include the Semiconductors Industry Association's formation of the Semiconductors Research Cooperative (involving universities) and Control Data's proposed Microelectronics and Computer Technology Enterprises.

B. Joint Research Ventures

The following examples include joint research ventures among firms, (i.e, not conducted under the more permanent institutional structure A above). This list comes from the Department of Justice and represents joint ventures which sought a ruling on antitrust implications from the Department of Justice, 1968-1980.

1. Transportation Association of America -- Industry-wide development and standardization project.

2. Chicago Bridge & Iron Co. - General Electric Co. -- Joint development and manufacturing: Nuclear power plants.

3. Hercules, Inc. - Petroleum Technology Corp. -- Development and commercialization: explosives.

4. Computer-Aided Manufacturing-International, Inc. Industry-wide basic and applied research: computer assisted manufacturing.

5. Northern States Power Co. et. al. Applied research and development, standardization: nuclear power plant production.

6. Westinghouse Electric Corp. - Tenneco Power Systems, Inc. -- Joint development and manufacture: nuclear power plant construction.

7. United Technologies et. al. -- Development and manufacture: aircraft engines.

8. Salk Institute et. al. -- Development and commercialization: pharmaceuticals.

9. Metal Treating Institute -- Industry-wide basic research: energy efficiency.

10. Chemical Institute of Toxicology -- Basic research and testing: chemicals.

11. Aerovox Industries et. al. -- Industry-wide applied research: substitute for possible carcinogen.

12. Nebraska Electronic Terminal System -- Industry-wide development and operation: electronic funds transfer systems.

13. Insurance Institute For Research -- Industry-wide applied research, potential development and operation: insurance communication network.

14. Proprietary association -- Industry-wide applied research: pharmaceuticals.

15. American National Red Cross -- Development and Manufacture: blood fractionation.

16. Cooperative Automotive Research Program -- Industry-wide, government-sponsored basic research: automative industry.

17. General Atomic Company -- Joint research and development: nuclear reactors.

18. American Shoe Center--Research, standardization, manufacturing methods; footwear manufacturing.

19. Ocean Margin Drilling Program -- Joint research and scientific exploration; continental shelf.

C. Limited Research Partnerships

These are essentially royalty partnerships to fund product development. They are apparently becoming more popular with firms. There is no way of knowing how many such arrangements there are in existence. A few current examples include:

1. The Lear Fan Research Partnership which funded the product development for the Lear 2100 turbo fan aircraft -- $30 million. 1980.

2. Delorean Research Limited Partnership which funded the development of the DMC-12 automobile -- $18 million. 1978.

3. Agrigenetics Research Association Limited which is funding the development of hybrid seed stocks through genetic engineering -- $40 million in 1981, $15 million in 1982.

4. Technology Funding Inc. has established eight limited research partnerships in the last two and a half years including:

   a. Interaction Cable Technology for $3.7 million in 1981-82, and
   b. Micro Storage Systems for $.9 million in 1982.

5. Storage Technology Corp. raised $50 million in 1981.

6. Trilogy Ltd. is raising $55 million in 1982.

II. University-Industry Cooperation

There appears to be a new wave of activity directly between firms and universities. These arrangements can take many forms including multisponsored research proposed and performed by a university and individual company-to- university relationships or projects proposed by companies.
Current examples include:

1. The University of Deleware's Center for Composite Materials,

2. The proposed New York State Center of Industrial Innovation at Rensselaer Polytechnic Institute,

3. The Robotics Institute at Carnegie-Mellon University.

4. The MIT relationship with Exxon for long term research in the area of carbonaceous fuel combustion.

In the area of biomedical science and technology alone, a recent report prepared for the National Institutes of Health lists the following selected university-industry agreements:

UNIVERSITY & INDUSTRY NAMED	TIME FRAME & DOLLAR AMOUNTS	TYPE OF AGREEMENT	RESEARCH FOCUS
Harvard University Medical School -Monsanto	12 years -- $23 million	- endowment and research support - research materials	- "Biology and Biochemistry of Organ Development"
Mass. General Hospital (Harvard Medical School) Hoecht, A.G.	10 years - $50 million (accompanied by private gift of $15 million for construction of molecular biology lab facility)	Grant - (Creation of Genetic Engineering Dept.)	Genetic Engineering Molecular Biology- Insulin, Growth Hormone, Interferon
Harvard Medical School DuPont	5 years -- $6 million	Grant	Molecular Genetic Research--DuPont Interested in Interferon
MIT--Whitehead Foundation	$7.5 million initially-Bio. Dept. Funding & Admin. costs $20 million to build Whitehead Institue for Biomedical Research $60 million Trust, will supply $5 million annually for operating expenses	Creation of Biomedical Research Complex	Developmental/ Molecular Biology
MIT -- Flow Laboratories	$400,000 per year	Royalty Payments for use of MIT Patent (Half of amount will go to MIT Dept. of Nutrition and Food Science)	Cell Culture Technique Micro-carriers-for Production of Interferon
Washington University-- Mallinckrodt, Inc.	3 years -- $3.9 million	N/A	Genetic Research Focusing on "Hybridons" Technology - Monoclonal Antibodies

UNIVERSITY & INDUSTRY NAMED	TIME FRAME & DOLLAR AMOUNTS	TYPE OF AGREEMENT	RESEARCH FOCUS
Stanford -- UC/Berkeley 6 corporations - Bendix Corp., General Foods, Elf Technologies (ELF Aquataine), Koppers Corp., Maclaren Power & Paper Company, (Noranda), Head Corporation	4 years -- $20 million ($2 million of this to be split between the universities over 4 years, to support basic research.) Capital appreciation or stock dividends generated by Engenics will be plowed back into Stanford's Dept. of Medical Microbiology & the Chemical Engineering Dept. of both schools.	- Creation of nonprofit foundation to support academic research in genetic engineering (Center for Biotechnology Research) and creation of Engenics, a for-profit arm of that foundation which will concentrate on development of commercial biotechnology processes. - Stanford has a "sponsored Research Contract" with Center for Biotechnology Research.	- Genetic Engineering "Development of Continous Fermentatio Processes & Equipment designed to boost production & lower costs of systems employing genetically engineered organisms"
University of California/ Davis -- Allied Chemical Corp.	5 years -- $2.5 million	Grant	Using Recombinant DNA techniques to attempt to confer nitrogen fixation capabilities on plants which do not naturally possess that ability.
Stanford -- UC/San Francisco Multiple Corporations (E.G.: Eli Lilly & Co., Schering Plough, Smith Kline Corp., DuPont Co.)	Initial fee of $10,000 Annual fee of $10,000 Royalty rate: 1% on net sales of products up to $5 million 0.5% on sales above $10 million annually.	Patents Licensing Agreement (on patent granted to Stanford and UCSF in Dec., 1980, for techniques invented by Stanley Cohen of Stanford & Herbert Boyer of UCSF)	Basic gene splicing and Cloning

NON-PROFIT INSTITUTION INDUSTRY NAMED	$ AMOUNT & TIME FRAME	TYPE OF AGREEMENTS	RESEARCH FOCUS
Salk Institute-- Phillips Petroleum	$10 million	Purchase of 37% equity interest in for-profit, previously wholly owned subsidiary of Salk Institute, now called Institute Biotechnology/Industrial Association, Inc.	Genetic Engineering; attempt to commercialize applications of Recombinant DNA and other Genetic Engineering methods
Scripps Clinic & Research Foundation-- Johnson & Johnson	Undisclosed sum (estimated to be $30 million)	N/A ("Joint venture") - ("Additional funding source") will include funds for a new research building	Production of synthetic vaccines
Scripps Clinic & Research Foundation-- Eli Lilly & Company	N/A	N/A	N/A
Battelle Memorial Institute Welzman Institute Baxter Laboratories -Multiple investors & corporations (E.G. Allied Chemical, Johnson & Johnson)	$40 million (Project abandoned)	Creation of DNA Science - "Would function like a holding company" -- small subsidiary companies established near major universities -- "Scientist would have an equity interest in company and be a consultant to it, but would remain on campus"	Producing & testing genetically engineered interferon monoclonal antibodies; production & testing of hormonal proteins, including human growth hormone

Mr. BROWN. The subcommittee stands adjourned.

[Whereupon, at 4:50 p.m., the subcommittee recessed, to reconvene at the call of the Chair.]

APPENDIX

ADDITIONAL STATEMENT SUBMITTED FOR THE RECORD

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

ASHRAE / 1791 Tullie Circle, N.E. / Atlanta, GA 30329 Telephone / 404-636-8400

Dr. Jack B. Chaddock, P.E.
President

Reply to: Mechanical Engineering &
Materials Science
Duke University
Durham, NC 27706
Tel / 919-684-2192

March 15, 1982

Representative Doug Walgren, Chairman
Science, Research and Technology Subcommittee
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) has followed your Subcommittee's hearings with interest on the authorization of the National Bureau of Standards. The work of the Bureau's Center for Building Technology has been of valuable assistance to ASHRAE in its role as a professional society developing design practices and voluntary standards used by design professionals in the buildings-related field.

Last January, our Board of Directors reaffirmed its feeling concerning the valuable contribution by the Center of Building Technology to the private sector by the Board's approval of a statement to that fact. I thought the brief statement of our Board might well be of assistance to your Committee in its deliberations, and therefore I am enclosing it for possible inclusion in the hearing's record.

Sincerely,

Jack Chaddock

Jack B. Chaddock
President

The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) is a professional society of over 40,000 individual members in North America, with world-wide affiliates. (There are no corporate members.) Its mission is to advance the arts and sciences in the fields of building technology and refrigeration covered in its title.

ASHRAE has been developing standards, handbooks and other technical data for many years which help provide more productive, energy efficient, and economic buildings, and their heating, ventilating, air conditioning and refrigeration systems.

ASHRAE conducts its own research program, which is now at a scale of over $15 per member per year. This is small compared to the construction industry needs in the face of energy problems, foreign competition, and capital shortages. ASHRAE is concerned that Federal energy conservation research is being reduced, especially when, according to DOE studies, up to 15% of the total U.S. energy use potentially can be avoided by cost-effective energy conservation strategies applied in the building sector.

ASHRAE has benefited greatly from the energy conservation work of the National Bureau of Standards (NBS) in the non-proprietary areas of measurement technology, evaluation methodology, and technical data, much of which has been used by ASHRAE in developing its extensive voluntary standards and other documents which provide bases for innovation by the private sector.

As the responsibilities for energy conservation research of the Department of Energy (DOE) are transferred to the Department of Commerce (DOC), ASHRAE requests that support be maintained for NBS's Center for Building Technology (CBT) so it may continue effectively to support the building community.

Approved by the ASHRAE Board of Directors - January 26, 1982

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.